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Volume LXVI January -March 1998

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THE GENUS *BISCOGNIAUXIA*

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ABSTRACT

Forty-nine taxa are recognized in ***Biscogniauxia***. Six species—***B. africana***, ***B. arima***, ***B. communapertura***, ***B. plumbea***, ***B. reticulospora***, and ***B. zelandica***—and three varieties—***B. atropunctata*** *var.* ***intermedia***, ***B. capnodes*** *var.* ***limoniispora***, and ***B. philippinensis*** *var.* ***microspora***—are newly described. Eleven new combinations are made: ***B. albosticta***; ***B. atropunctata*** *var.* ***maritima***; ***B. capnodes***; ***B. capnodes*** *var.* ***rumpens***; ***B. capnodes*** *var.* ***theissenii***; ***B. kalchbrenneri***; ***B. mediterranea*** *var.* ***macrospora***; ***B. mediterranea*** *var.* ***microspora***; ***B. plana***; ***B. sinuosa***; and ***B. uniapiculata*** *var.* ***indica***. ***Biscogniauxia schweinitzii*** is introduced as a substitute for ***B. macula***. A dichotomous key is provided along with a list of diagnostic characteristics of certain taxa. A list of known names of ***Biscogniauxia*** and its synonyms is included.

Key Words: ***Biscogniauxia***, ***Camillea***, ***Hypoxylon***, ***Jumillera***, ***Nodulisporium***, ***Nummularia***, systematics, Xylariaceae, ***Whalleya***

Nummularia Tul. & C. Tul. was erected in 1863 by the Tulasne brothers on a suite of characters that has been used to the present time to distinguish these fungi from their kin (Tulasne and Tulasne, 1863). ***Nummularia*** is particularly descriptive of many of these fungi which, in fact, have flattened, disc-shaped stromata reminiscent of coins. Unfortunately, ***Nummularia*** Tul. & C. Tul. is a later homonym of ***Nummularia*** Hill, a genus of the angiospermous Primulaceae. The nondescriptive name, ***Biscogniauxia*** Kuntze, was adopted for the genus (Pouzar, 1979). In any case, the Tulasne brothers understood ***Biscogniauxia*** [as ***Nummularia***] extremely well and, indeed, their observations on stromatal development have not been improved upon in 133 years!

Most mycologists accepted the Tulasne concept of ***Biscogniauxia*** and numerous additional species were described. Curiously, a great student of the Xylariaceae, J. H. Miller, moved most of the applanate species of ***Biscogniauxia*** [as ***Nummularia***] to section ***Applanata*** of ***Hypoxylon*** (Miller, 1961). In doing so, he apparently chose to diminish the importance of developmental differences between ***Biscogniauxia*** and ***Hypoxylon***. His section ***Applanata*** thus contains taxa of ***Camillea*** Fr., ***Jumillera*** J. D. Rogers, Y.-M. Ju, & San Martín, ***Whalleya*** J. D. Rogers, Y.-M. Ju, & San Martín, as well as ***Biscogniauxia*** (Laessøe, 1994; Rogers et al., 1997). Martin (1969) presented an expanded concept of ***Biscogniauxia*** [as ***Numulariola*** House] that included taxa of ***Camillea***, ***Camarops*** P. Karst., ***Peridoxylon*** Shear, and ***Bolinia*** Nitschke, and others. This concept is considered untenable by most modern workers.

In this treatment ***Biscogniauxia*** embraces fungi with the following characteristics:

1. Bipartite stroma, the outer layer of which dehisces or disintegrates to expose the ascoma-bearing part below. The former layer often is sloughed along with overlying bark.
2. Stout conidiophores that are usually ***Periconiella***-like in morphology and, in nature, are borne between the dehiscing and underlying stromatal layers. Conidia are dry.
3. Internal carbonaceous, or in several cases noncarbonaceous, locules that bear individual papyraceous perithecia. Stromata with mature perithecia usually lack white tissue either between or beneath perithecia.
4. Stromata that do not release colored pigment in KOH.
5. Ascospores that are usually dark in color and usually feature a conspicuous germination slit. In the case of taxa with ascospores bearing a hyaline appendage cell, the darker part bears a germination slit.
6. Ascospores that are essentially nonornamented. Two taxa have striate ascospores, one has ribbed ascospores, and one has reticulate ascospores (see later).
7. Asci with short stipes (as compared with the spore-bearing part) and an iodine-positive apical ascus ring that is broader than high. Rings of some species stain light blue toward the apex and darker blue below.

Biscogniauxia species are probably, without exception, bark parasites. They develop within the bark and forces produced between the inner and outer stromatal layers, and the raised rims of some taxa, break the overlying bark. Wood beneath the bark is decayed to some extent, the decay being a physiological white rot, i.e., both cellulose and lignin are degraded. Sacs composed of darkened hyphae are sometimes formed and cuts through them appear as delicate brownish or blackish lines, so-called zone lines.

ECOLOGY AND HOST-FUNGUS RELATIONSHIPS

Biscogniauxia taxa are exclusively parasites of dicotyledonous angiosperms. The most recent host-fungus index for the USA lists 5 taxa on various hosts (Farr et al., 1989). Some other taxa—not all of which are considered herein to be ***Biscogniauxia***—are listed under ***Nummularia***; hosts are dicots. Collection data suggest host preferences, if not host specificity, among ***Biscogniauxia*** taxa. In Great Britain (and probably throughout Europe) ***B. nummularia*** (Bull.: Fr.) Kuntze is usually encountered on ***Fagus*** *spp.* (Cannon et al., 1985). ***Biscogniauxia marginata*** (Fr.: Fr.) Pouzar [classically known as ***Nummularia discreta*** (Schwein.) Tul. & C. Tul.] is often, but not exclusively, encountered on trees of family Rosaceae. It causes a classic canker disease called nail-head, a reference to the more or less flat-topped stromata; this is also often called blister disease (Hepting, 1971). ***Biscogniauxia atropunctata*** (Schwein.: Fr.) Pouzar [as ***Hypoxylon***] is said to cause a bark disease of ***Carya***, ***Fagus***, and ***Quercus*** species in northern Georgia; it is suspected that lack of vigor predisposes trees to invasion by the fungus (Hepting, 1971). Bassett et al. (1982) implicated the same fungus as causing cankers on oaks in Arkansas. Bassett and Fenn (1984) showed experimentally that girdling of healthy-appearing ***Quercus*** *spp.* trees resulted in the production of ***B. atropunctata*** stromata on 70% of white oaks (subgenus ***Leucobalanus***) and 77% of black (red) oaks (subgenus ***Erythrobalanus***) within 5 months. They concluded that fruiting occurred following girdling by stimulating the activity of mycelium from latent infections. Tainter and Gubler (1973) believed that lowered levels of survival of the oak wilt fungus [***Ceratocystis fagacearum*** (Bretz) Hunt] in oaks resulted from the rapid decay of sapwood by ***B. atropunctata***. ***Biscogniauxia mediterranea*** (De Not.) Kuntze has been implicated in the death and destruction of ***Quercus robur*** in Portugal and North Africa (Barbosa, 1958; Malençon and Marion, 1951). Roger (1953) mentions two taxa [as ***Nummularia***] on ***Hevea***, considering them to be "semi-parasites."

We suspect that all ***Biscogniauxia*** species are at least weak pathogens, invading hosts that are weakened by drought, etc. and fruiting when the host is highly weakened or dead. These fungi could be classified as facultative saprophytes, i.e., spending most of their cycles as parasites, but capable of persisting for periods on dead material. Experience in Hawaii (JDR) and elsewhere indicates that dying or dead branches on many trees have evident stromata of a ***Biscogniauxia*** species and often a ***Eutypella*** species. Once branches fall to the ground, however, they are invaded by basidiomycetes—often a number of species (R. W. Gilbertson, personal communication)—, but additional xylariaceous inhabitants seem infrequent. We take this to mean that ***Biscogniauxia*** (and ***Eutypella***) are parasites that persist on dead material that was fallen to the ground, but probably do not invade such material. Indeed, once material has fallen these taxa probably cannot compete with climax rotters, mostly basidiomycetes. Specific parasite-host combinations noted in the Hawaiian Islands are ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers on ***Metrosideros polymorpha*** Gaud.,

Acacia koa Gray, ***Eucalyptus*** *sp.*, ***Acacia*** *sp.*; ***B. citriformis*** (Whalley, Hammelev, & Taligoola) Van der Gucht & Whalley on ***Casuarina equisetifolia*** L. *ex* J. R. & G. Forst., and numerous other unidentified decaying branches; ***B. uniapiculata*** (Penz. & Sacc.) Whalley & Laessøe on ***Metrosideros polymorpha***, ***Acacia koa***, ***Eucalyptus*** *sp.*, ***Aleurites moluccana*** (L.) Wild., and ***Psidium cattleianum*** Sabine. Whalley (1993) and Rogers (1979) cite other examples in ***Biscogniauxia*** and other xylariaceous genera. Reference to Hepting (1971) indicates that ***Biscogniauxia*** species [as ***Hypoxylon*** and ***Nummularia***] are not generally regarded as serious pathogens of forest trees.

All experimental and observational evidence indicates that ***Biscogniauxia*** species are adapted to dry, or at least seasonally dry, habitats. Development within bark probably buffers developing stromata from drying. Sufficient water for the activities of these fungi in dead or drying trees is probably via the decomposition of cellulose with the consequent production of water molecules.

DEVELOPMENTAL ASPECTS

The fullest accounts of development in ***Biscogniauxia*** are those of the Tulasne brothers (1863) [as ***Nummularia***]. Rogers (1967) elucidated the developmental cytology of ascospores of ***Biscogniauxia grenadensis*** (J. H. Miller) Whalley & Laessøe *var.* ***macrospora*** (J. H. Miller) Whalley & Laessøe [as ***Hypoxylon***]. Ascospores are initially uninucleate. Most frequently, one mitosis occurs; one of the two resulting nuclei is cut off in a cellular appendage. In some cases the nucleus in the spore body divides again, one of the nuclei becoming located in the end of the spore body opposite the appendage. In a few instances no appendage is formed and the spore body matures in a bi- or trinucleate condition. Most ascospores have a mature brown body cell and an appendage in which the nucleus disintegrates. Frequently, the appendage dehisces, resulting in a brown ascospore with a conspicuously truncate end. Cytological phenomena are similar in ***B. anceps*** (Sacc.) J. D. Rogers, Y.-M. Ju, & Cand. (Rogers et al., 1996). In that species, however, both the body cell and the appendage cell of most ascospores remain hyaline and both can germinate. The evolutionary implications of these observations are discussed later.

Ju and Rogers (1996) have discussed the gross anatomy of ***Biscogniauxia*** stromata. Perithecia are usually contained within individual carbonaceous locules. They are usually easily removable as individual sacs, a feature commonly seen in ***Camillea*** and ***Rosellinia***, but observed much less frequently in ***Hypoxylon***, ***Daldinia***, and most other xylariaceous genera. Large perithecia (0.3 mm diam or above) of most taxa communicate with the external environment by individual ostiolar canals. Smaller perithecia (less than 0.3 mm diam) often have communal ostiolar canals shared by two or more perithecia. A species newly described herein, ***B. communapertura*** Y.-M. Ju & J. D. Rogers, produces numerous perithecia in rosettes, each rosette having a single ostiole. One becomes aware of this by observing that the stromatal surface features a relatively few scattered ostioles for a large number of small perithecia. Taxa in the related genus, ***Camillea***, much more frequently show shared ostiolar canals. We consider it to be a relatively advanced feature.

CULTURES AND ANAMORPHS

One characteristic of undoubted ***Biscogniauxia*** species is the general behavior on SME medium (Kenerley and Rogers, 1976) and on 2% oatmeal agar (OMA). On the former medium growth is rapid, a 9 cm diam Petri plate being covered in 7–10 days. The turf is white and thin except for grayish areas where the anamorph is forming. Advancing margins are more or less ropy. On OMA growth is somewhat less rapid. Colonies are usually lanose with gray colors. The reverse of numerous taxa is at first deep green, darkening to black; the reverse of some others is uncolored. Colonies of fungi that behave on both media substantially differently than summarized here are suspected to be of different genera. Color codes in culture descriptions follow Rayner (1970).

Anamorphs in culture are a variation of ***Nodulisporium*** Preuss, usually considered to be ***Periconiella***-like (Callan and Rogers, 1986; Jong and Rogers, 1972; Ju and Rogers, 1996). Conidiophores are coarse, usually becoming warty and brown at maturity. Conidia are produced holoblastically from conidiogenous areas that become swollen from repeated conidial production in a limited area. Conidiogenous cell proliferation is essentially sympodial. Branching is from a main axis with apparent "apical dominance." This type of conidial apparatus is found in some ***Hypoxylon*** species and is illustrated by Ju and Rogers (1996). Conidia are mostly ovoid to obovoid with a flattened secession scar. They are dry and easily disseminated by wind. In nature, conidia are mostly observed borne between layers of immature stromata, filtering out of ruptures or blowing off of areas where the overlying bark has sloughed. It is known that the conidial states are produced from invaded substrates at times of year when stromata are not being produced, but the extent has not been assessed. Conidia of many, if not all, ***Biscogniauxia*** species germinate (see Callan and Rogers, 1986). They are undoubtedly, along with ascospores, effective inoculum.

GENERIC AFFINITIES AND EVOLUTION

Biscogniauxia is without doubt a genus of Xylariaceae. The taxa included in the genus have evolved with angiosperms on seasonally dry sites (see earlier herein; Rogers, 1979). The significant number of species with dark ascospores bearing a hyaline cellular appendage supports the argument that the ancestors of ***Biscogniauxia*** had two-celled hyaline ascospores. ***Biscogniauxia anceps***, with a great preponderance of two-celled hyaline ascospores, probably represents a neotenic situation, i.e., a reversion of ascospores to a juvenile state that, in fact, recapitulates the mature ancestral ascospores (Rogers et al., 1996; Rogers, 1979). It is probable that the ancestral taxa would fit in family Amphisphaeriaceae *sensu* Müller and von Arx (1973) and had (have) many of the features of ***Vivantia*** J. D. Rogers, Y.-

M. Ju, & Cand. (Rogers et al., 1996). A curious collection of a ***Biscogniauxia*** sent to us by Françoise Candoussau [GUADALOUPE: Basse Terre, Cabout, XI.1987, Vivant, J., GUAD-213, wood (JDR)] has brown ascospores with broad-based hyaline appendage cells, with narrow-based hyaline appendage cells, and lacking appendages altogether. This fungus appears to be transitional between those ***Biscogniauxia*** species with persistent appendages and those without. Like ***B. anceps***, this fungus seems to have a loose or leaky regulatory control over ascospore cytology and final ascospore morphology. ***Biscogniauxia fuscella*** (Rehm) San Martín & J. D. Rogers likewise often shows an appendage on some maturing ascospores, but other maturing ascospores lack an appendage altogether.

The degree of carbonization of the stroma surrounding perithecia seems greatest among those taxa with the primitive ascospore trait, i.e., two-celled ascospores (Ju and Rogers, 1996). Species in section ***Annulata*** of ***Hypoxylon*** seem to show a relationship to ***Biscogniauxia*** in the dehiscence of a portion of stroma surrounding the ostiole, i.e., represents the last vestige of an outer dehiscent stromatal layer. Annulate ***Hypoxylon*** species generally retain a degree of carbonization surrounding perithecia; this is almost totally lacking in taxa of section ***Hypoxylon*** (Ju and Rogers, 1996). Stromata of ***Biscogniauxia*** lack discernible pigments in KOH, in contrast with most ***Hypoxylon*** species. Such pigments probably are associated with light absorption and ascospore release and have selective value in fungi that are completely erumpent from bark or otherwise exposed to high light intensities, i.e., ***Hypoxylon***, ***Daldinia***, etc.

Ascospores of ***Biscogniauxia*** lack dehiscent perispores, an innovation that is apparent in more advanced groups such as ***Hypoxylon*** and ***Daldinia*** (Ju and Rogers, 1996). These latter two taxa also lack appendaged ascospores altogether (Ju and Rogers, 1996; Ju et al., 1997).

The genus most closely related to ***Biscogniauxia*** is ***Camillea*** Fr. The latter genus has bipartite stromata as in ***Biscogniauxia***. Stromata of ***Camillea*** species, however, are more highly specialized, often having unusual receptacles for ascospore discharge and/or ostioles serving multiple perithecia (Laessøe et al., 1989). Ascospores are pale-colored, ornamented with complex rods and/or reticulations, and lack a germ slit (Laessøe et al., 1989). Ascospores of one species are highly multinucleate (Rogers, 1968). Most of them germinate in low percentages or not at all. Asci tend to have rounded or diamond-shaped apical rings. Anamorphs are referable to ***Xylocladium*** Syd. *ex* Lindau, but, in culture, sometimes appear ***Nodulisporium***-like by failure to produce the characteristic ampullae (Jong and Rogers, 1972). ***Camillea*** species are almost entirely found in the Americas, particularly the American tropics (Laessøe et al., 1989), whereas ***Biscogniauxia*** is represented by species worldwide.

The actual relationship of ***Biscogniauxia*** with ***Camillea*** is unknown. It is believed that ***Biscogniauxia*** is the older genus, based upon its wider distribution and simpler stromatal configurations. It is probable that ***Camillea*** species evolved under pressure from vectors that distribute ascospores, accounting in part for the bizarre and fascinating stromata (Laessøe et al., 1989). Interestingly, one species of ***Biscogniauxia—B. reticulospora*** Y.-M.

Ju & J. D. Rogers—has reticulate ascospores. Unfortunately, cultures could not be obtained from it.

Another genus with an apparent relationship to ***Biscogniauxia*** is the monotypic ***Obolarina*** Pouzar (Pouzar, 1986). The Tulasne brothers described the fungus as a ***Nummularia***, but recognized that it is atypical primarily in not producing a conidial state within the stroma (Tulasne and Tulasne, 1863). Candoussau and Rogers (1990) showed that, at least in culture, conidia of ***O. dryophila*** (Tul. & C. Tul.) Pouzar are infrequently produced from very rudimentary conidiophores. The asci also lack an apical ring. Ostioles are rudimentary and inconspicuous. It appears that ***Obolarina*** illustrates an evolutionary trend in the direction of cleistocarpy.

The Tulasne brothers were among the first to realize that the Diatrypaceae and ***Biscogniauxia*** [as ***Nummularia***] had some features in common (Tulasne and Tulasne, 1863). They showed that ***Diatrype stigma*** (Hoffm.: Fr.) Fr. [as ***Stictosphaeria hoffmanni***] develops in bark, but were somewhat equivocal on the presence of a dehiscent outer stromatal layer. They discussed and illustrated the moist-spored anamorph that was said to develop in "spermogonia."

Munk (1957) discussed "points" where the Diatrypaceae and Xylariaceae seemed to impinge. He believed that the Xylariaceae was moving toward small asci and pale allantoid ascospores. He merged the families, reducing Diatrypaceae to tribe Diatrypeae. While we agree that there is a good deal of commonality between these families, we would not merge them. We especially doubt that ***Camarops*** is closely related to either the Diatrypaceae or Xylariaceae (see Rogers, 1994). Our suspicions of a relationship of ***Biscogniauxia*** with the Diatrypaceae comes primarily from culturing a fungus probably equatable with ***Nummularia viridis*** Theiss. (Ju et al., 1993). This fungus has fairly small ascospores and whitish tissue surrounding small perithecia. On culturing the fungus yields long, curved conidia in wet masses that, like those of undoubted Diatrypaceae, do not germinate. This fungus, along with several others such as ***Hypoxylon hypophlaeum*** (Berk. & Ravenel) S. Teng, is removed from ***Biscogniauxia*** to ***Jumillera*** and is not considered further herein (Rogers et al., 1997). Moreover, ***Nummularia microplaca*** (Berk. & M. A. Curtis) Cooke—a taxon with small ascospores, bipartite stroma, and dry scolecosporous anamorph that inhabits members of the aromatic angiospermous families Lauraceae and Myrtaceae—is placed in ***Whalleya*** (Rogers et al., 1997).

It is uncertain if ***Jumillera*** and ***Whalleya*** represent a convergence with undoubted taxa of the Diatrypaceae or if, in fact, they have a common ancestry and are evolving in parallel (see Rogers, 1994). Another genus that seems to have interfaces with the Xylariaceae and Diatrypaceae is ***Graphostroma*** Piroz. This monotypic genus, currently placed in family Graphostromataceae, has stromata reminiscent of ***Diatrype*** or ***Biscogniauxia***, but has an anamorph similar to the latter (see Barr et al., 1993). ***Graphostroma*** has ascospores that approach an allantoid shape and asci that are somewhat like those of undoubted Diatrypaceae. No undoubted member of the Xylariaceae has allantoid ascospores or long-stipitate asci with the characteristic shape of those of the Diatrypaceae.

KEY TO GENERA LIKELY TO BE CONFUSED WITH *BISCOGNIAUXIA*

1. Ascospores hyaline, subhyaline, pale brown (or occasionally brown) 2
1. Ascospores brown or at least one cell of a bicellular ascospore brown....4*

    2. Ascospores bicellular, permanently hyaline .... ***Vivantia***
    2. Ascospores unicellular, hyaline to brownish......................................3

3. Ascospores hyaline, suballantoid, smooth; anamorph a ***Nodulisporium***... ....***Graphostroma***
3. Ascospores hyaline to brownish, variously shaped, intricately ornamented when viewed with scanning electron microscopy; anamorph a ***Xylocladium*** in taxa that have been cultured............................ ***Camillea***

    4. Ascospores unicellular, arranged irregularly in clavate ascus that lacks an apical ring .... ***Obolarina***
    4. Ascospores unicellular or bicellular with one cell a hyaline appendage; asci cylindrical with an apical ring that usually blues in iodine...5

5. Perithecia embedded in white fungal tissue or a mixture of fungal and host tissue; conidia elongated, usually scolecosporous...........................6
5. Perithecia embedded in carbonaceous or at least dark-colored stromatal locules; conidia usually amerosporous .... ***Biscogniauxia***

    6. Anamorph hyphomycetous, producing dry elongated conidia***Whalleya*** [See also ***Lopadostoma pouzarii*** (Granmo and Petrini, 1996).]
    6. Anamorph coelomycetous, producing elongated conidia in slimy masses and, in some taxa, with a hyphomycetous synanamorph producing dry amerosporous conidia.................................. ***Jumillera***

Biscogniauxia Kuntze, Rev. Gen. Plant. II, p. 398. 1891.
TYPE: ***B. nummularia*** (Bull.: Fr.) Kuntze [≡ ***Hypoxylon nummularium*** Bull.: Fr.]
≡ ***Nummularia*** Tul. & C. Tul., Sel. Fung. Carp. II, p. 42. 1863.
LECTOTYPE [selected by Maire (1930) and Shear (1930)]: ***N. bulliardi*** Tul. & C. Tul. [≡ ***Hypoxylon nummularium*** Bull.: Fr.]
≡ ***Kommamyce*** Nieuwland, Amer. Midl. Naturalist 4: 375. 1916.
TYPE: ***K. bulliardi*** (Tul. & C. Tul.) Nieuwland [≡ ***Nummularia bulliardi*** Tul. & C. Tul. ≡ ***Hypoxylon nummularium*** Bull.: Fr.]
≡ ***Numulariola*** House, New York State Mus. Bull. 266: 49. 1925.

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* In ***Biscogniauxia anceps*** ascospores with a colored cell are often difficult to find.

LECTOTYPE [selected by Laessøe (1994)]: ***Nummularia bulliardi*** Tul. & C. Tul. [≡ ***Hypoxylon nummularium*** Bull.: Fr.]

= ***Albocrustum*** C. G. Lloyd, Mycol. Writings 7: 1353. 1925.

TYPE: ***A. atropunctatum*** (Schwein.) C. G. Lloyd [≡ ***Sphaeria atropunctata*** Schwein.]

= ***Nummulariella*** Eckblad & Granmo, Norweg. J. Bot. 25: 69. 1978.

TYPE: ***N. marginata*** (Fr.: Fr.) Eckblad & Granmo [≡ ***Sphaeria marginata*** Fr.: Fr.]

Stromata applanate, effused-pulvinate, or raised-discoid, solitary or confluent, with or without raised margins, bipartite with outer layer dehiscent, often adhering to overlying bark; innermost layer at first bearing anamorph or fugaceous papyraceous remains of anamorph, at length attaining a characteristic mature white, dark brown, or black surface color; mature stromata lacking KOH-extractable pigments, plane or with inconspicuous perithecial mounds; carbonaceous tissue immediately beneath surface; tissue between perithecia woody or carbonaceous; tissue beneath perithecia inconspicuous or conspicuous, composed of fungal tissue, host tissue, or both. Perithecia obovoid, tubular, or long tubular, monostichous, with or without carbonaceous stromatal material surrounding individual perithecia. Ostioles at the same level as stromatal surface or lower than stromatal surface and with openings punctate, or higher than stromatal surface and with openings papillate; one ostiole sometimes serving several perithecia. Asci eight-spored, cylindrical, short-stipitate, persistent, with apical ring discoid, amyloid or infrequently inamyloid; ring in some taxa staining light blue in apical part and darker blue below. Ascospores pale brown, light brown, brown, dark brown, or blackish brown, unicellular in both immature and mature ascospores or with mature ascospores bearing a hyaline cellular appendage, or, in one species, with both cells often remaining hyaline, ellipsoid or short fusoid, inequilateral, slightly inequilateral, or nearly equilateral, with acute, narrowly rounded, or broadly rounded ends, with straight or sigmoid germ slit spore-length to much less than spore-length, or lacking germ slit; perispore indehiscent in 10% KOH; epispore smooth or occasionally ornamented.

NOTES: Cooke (1883) divided ***Nummularia*** taxa into two sections: section A for taxa with a concave stromatal surface and section B for taxa with a convex stromatal surface. Pouzar (1986) recognized two sections for ***Biscogniauxia***: ***Biscogniauxia*** and ***Scleraster*** Pouzar. These two sections were separated on morphology of stromatal margins and on colors and amounts of the stromatal tissue beneath the perithecial layer. Whalley and Laessøe (Whalley et al., 1990a, 1990b) erected section ***Appendiculata*** to accommodate taxa with appendaged ascospores. We do not assign ***Biscogniauxia*** species to sections or subgenera because the boundaries between the established sections are not well-delimited and may become less so when more collections have been studied. For instance, ***Biscogniauxia cinereolinacina*** and ***B. repanda*** were placed by Pouzar (1986) in sections ***Biscogniauxia*** and ***Scleraster***, respectively. It is our feeling that these two species are closely related and should not be separated into two different sections. Each has a reduced amount of carbonaceous tissue encasing each individual ostiole and a bilateral ascospore germ slit. Likewise, ***Biscogniauxia fuscella*** and an unnamed Guadeloupe collection GUAD-213 that was discussed above represent smudges on the boundaries between those taxa with appendaged ascospores and those without appendaged ascospores.

KEY TO TAXA OF ***BISCOGNIAUXIA***

1. Mature ascospores bearing a cellular appendage or with one flattened end indicating appendage loss .... 2[*]
1. Mature ascospores lacking a cellular appendage and/or a conspicuously flattened end .... 17[†]

2. Ascospores ornamented with striations 3
2. Ascospores not ornamented.. 4

3. Ascospores (22–) 25–28 (–30) x (8–) 9.5–10.5 (–12) µm .... ***B. weldenii***
3. Ascospores (17–) 18–21 x (7–) 8–10 (–11) µm ....
....***B. weldenii var. microspora***

4. Mature stromatal surface light orange brown; ascospores pale brown to light brown, 6–7.5 x 3.5–4 µm, apparently lacking a germ slit..........
.... ***B. waitpela***
4. Mature stromatal surface other than light orange brown; ascospores longer than 8 µm, with a germ slit 5

5. Ostiolar openings coarsely papillate 6
5. Ostiolar openings slightly papillate or umbilicate 7

6. Ascospores (12–) 13–14.5 (–15) x 7–8 µm..................... ***B. nothofagi***
6. Ascospores 22–33 x 12.5–15.5 µm ....***B. pithodes***

7. Ascospores mostly remaining hyaline when mature, 10–13 x 7–9 (–10) µm .... ***B. anceps***
7. Ascospores mostly with larger cell darkened when mature 8

8. Ascospores with a faint, broad germ slit on the more convex side..... 9
8. Ascospores with a conspicuous, narrow germ slit either on the more convex or on the less convex side 10

9. Ascospores 22–27 x 11.5–13 µm ....***B. philippinensis***

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[*] Ascospore size ranges given for taxa with appendaged ascospores do not include the appendage.

[†] ***Biscogniauxia fuscella*** bears a minute appendage on some mature ascospores.

9. Ascospores 13.5–19 x 8–10 µm .... ***B. philippinensis*** *var.* ***microspora*** *var. nov.*

10. Ascospores mostly longer than 15 µm 11
10. Ascospores mostly shorter than 15 µm 12

11. Ascospores (14–) 16–21 x 5–6.5 µm; known only from New Zealand .... ***B. zelandica*** *sp. nov.*
11. Ascospores 15–22 x 6–8 µm; known only from the Americas .... ***B. divergens***

12. Mature stromatal surface dark gray; ascospores 12–14.5 x 6–7 µm; known only from Hawaiian Islands .... ***B. plumbea*** *sp. nov.*
12. Mature stromatal surface other than gray 13

13. Mature stromatal surface brown to dark brown 14
13. Mature stromatal surface black 15

14. Ascospores 10–14 x 5–6 µm, with dark cell broadly rounded at end .... ***B. doidgeae***
14. Ascospores 12–16 x (5–) 5.5–7.5 µm, with dark cell narrowly rounded or pinched at end .... ***B. grenadensis***

15. Ascospores (9–) 10–14 x 5–7 µm, with germ slit spore-length or slightly less than spore-length; appendage 2-2.5 µm long .... ***B. uniapiculata***
15. Ascospores with germ slit less than spore-length 16

16. Ascospores 10–12 x 6–7.5 (–8.5) µm; appendage 2.5–4 µm long .... ***B. uniapiculata*** *var.* ***indica*** *comb. nov.*
16. Ascospores 13–15.5 x 7.5–10 µm; appendage 2–3 µm long .... ***B. uniapiculata*** *var.* ***macrospora***

17. Ascospores ornamented with longitudinal ridges or shallow reticulations 18
17. Ascospores smooth 19

18. Ascospores 26–30 x 7.5–10 µm, ornamented with longitudinal ridges .... ***B. sinuosa*** *comb. nov.*
18. Ascospores 27–34 x 14–15.5 µm, ornamented with reticulations .... ***B. reticulospora*** *sp. nov.*

19. Ascospores 7.5–9 x 3–4 µm, apparently lacking a germ slit .... ***B. arima*** *sp. nov.*
19. Ascospores larger, with a germ slit 20

20. Germ slit on both sides of the ascospore 21
20. Germ slit only on one side of the ascospore 25

21. Ascospores laterally compressed, subglobose 22
21. Ascospores not laterally compressed, ellipsoid 23

    22. Ostiolar openings punctate; ascospores 13–14.5 x 8.5–11.5 x 7–7.5 µm .... ***B. schweinitzii*** *nom. nov.*
    22. Ostiolar openings coarsely papillate; ascospores 17–22 x 11–14 x 9–10 µm .... ***B. querna***

23. Stromatal tissue between perithecia composed entirely of black, carbonaceous tissue; ascospores 15.5–19.5 x 6.5–8.5 µm .... ***B. albosticta*** *comb. nov.*
23. Stromatal tissue between perithecia composed of grayish brown to dark brown, woody tissue and black, carbonaceous tissue encasing individual ostioles reduced 24

    24. Stromata applanate; ascospores 12–16 (–17.5) x (4.5–) 5.5–8 µm .... ***B. cinereolilacina***
    24. Stromata raised-discoid; ascospores (8–) 9–14 x (4–) 4.5–6 µm .... ***B. repanda***

25. Stromata raised-discoid or short-cylindrical; ascospores 13–16.5 x 9.5–13.5 µm, with a sigmoid germ slit .... ***B. marginata***
25. Stromata various; ascospores with a straight germ slit 26

    26. Stromata raised-discoid, usually with conspicuously raised margins, with circular outlines 27
    26. Stromata applanate, lacking raised margins, usually with irregular outlines 32

27. Ostiolar openings papillate to coarsely papillate 28
27. Ostiolar openings punctate 30

    28. Ascospores light brown to brown, 10–13 x 4.5–5.5 (–6) µm .... ***B. africana*** *sp. nov.*
    28. Ascospores dark brown to blackish brown, greater than 13 µm long and 6 µm broad 29

29. Perithecia 0.3–0.5 mm diam; ascospores 15.5–21 x 10.5–13.5 µm; known only from Europe .... ***B. dennisii***
29. Perithecia 0.1–0.3 mm diam; ascospores 14–16.5 x 9.5–11.5 µm; known only from Australia .... ***B. baileyi***

    30. Stromatal tissue between perithecia carbonaceous; ascospores (9.5–) 10–12 (–13) x 5–6 µm .... ***B. kalchbrenneri*** *comb. nov.*
    30. Stromatal tissue between perithecia essentially dark brown, woody 31

31. Ostioles discretely encased by carbonaceous stromatal tissue; ascospores 13–17.5 x 5–6.5 µm; occurring on ***Rhamnus*** in Europe .... ***B. simplicior***
31. Ostioles not encased by carbonaceous stromatal tissue; ascospores 10.5–14.5 x 5–7 µm; occurring on ***Prunus*** in Europe .... ***B. pruni*** *nom. prov.*

32. Mature stromatal surface white 33
32. Mature stromatal surface other than white 35

33. Ascospores (20–) 23–30 x 11.5–14.5 µm .... ***B. atropunctata***
33. Ascospores smaller 34

34. Ascospores 16–22 x 7.5–11 µm .... ***B. atropunctata*** *var.* ***intermedia*** *var. nov.*
34. Ascospores 12–15.5 x 7–8 µm .... ***B. atropunctata*** *var.* ***maritima*** *comb. nov.*

35. Ascospores strongly inequilateral, often somewhat “C”-shaped 36
35. Ascospores more or less equilateral 37

36. Ascospores 10.5–12.5 x 5.5–7.5 µm .... ***B. citriformis***
36. Ascospores (12–) 13.5–17.5 x 6.5–9 µm .... ***B. citriformis*** *var.* ***macrospora***

37. Ascospores 8.5–10.5 x 5–5.5 µm, surrounded by a hyaline sheath .... ***B. mucigera***
37. Ascospores lacking a hyaline sheath 38

38. Outer dehiscing layer white; ascospores 13–16.5 x 6.5–8 µm, sometimes bearing a minute cellular appendage .... ***B. fuscella***
38. Outer dehiscing layer fawn-colored, brown, or dark brown; ascospores not bearing a cellular appendage 39

39. Stromatal tissue between perithecia composed entirely of gray, grayish brown, or dark brown, woody tissue 40
39. Stromatal tissue between perithecia composed entirely of carbonaceous tissue 41

40. Ascospores 17.5–22 (–25) x (8–) 9–11 (–12) µm .... ***B. bartholomaei***
40. Ascospores 10–13 (–14) x (6.5–) 7.5–8.5 µm .... ***B. nummularia***

41. Ascospores 8–11.5 x 4.5–6 µm, with a much less than spore-length germ slit; a number of perithecia usually sharing one ostiole .... ***B. communapertura*** *sp. nov.*

41. Ascospores with a spore-length germ slit; perithecia seldom or frequently sharing a common ostiole 42

 42. Ostiolar openings coarsely papillate 43
 42. Ostiolar openings slightly papillate or punctate 45

43. Ascospores 20–26 x 11.5–13 µm ....***B. mediterranea* var. *macrospora*** comb. nov.
43. Ascospores smaller 44

 44. Ascospores 15.5–21 x (6.5–) 7–10 µm .... ***B. mediterranea***
 44. Ascospores 12–17 x 5.5–7.5 µm ....***B. mediterranea* var. *microspora*** comb. nov.

45. Perithecia very narrow, ca. 0.05 (–0.1) mm diam x 0.3–0.5 mm high, with numerous individuals arranged in rosettes and sharing a single ostiolar canal; ascospores 11–14 x 5.5–7.5 µm .... ***B. plana*** comb. nov.
45. Perithecia more than 0.2 mm diam, usually not arranged in rosettes and usually with individual ostioles 46

 46. Ascospores lemon-shaped, 11.5–14 x 6–7.5 µm ....***B. capnodes* var. *limoniispora*** var. nov.
 46. Ascospores other than lemon-shaped 47

47. Ascospores (14–) 15–22.5 (–24) x 8–11 (–12) µm .... ***B. capnodes* var. *rumpens*** comb. nov.
47. Ascospores smaller 48

 48. Ascospores brown to dark brown, 8.5–15 x 5–7.5 µm ....***B. capnodes*** comb. nov.
 48. Ascospores light brown, 9.5–13.5 x 4.5–5 µm ....***B. capnodes* var. *theissenii*** comb. nov.

LIST OF DIAGNOSTIC CHARACTERISTICS OF CERTAIN TAXA

STROMATA:

- surface color of mature stromata:
  - * light orange brown: ***waitpela***
  - * whitish to grayish: ***atropunctata***, ***atropunctata*** var. ***intermedia***, ***atropunctata*** var. ***maritima***, ***cinereolilacina***, (***fuscella***), ***plumbea***
- surface color of outer dehiscing layer remaining at margins of mature stromata:
  - * whitish: (***atropunctata***), (***atropunctata*** var. ***intermedia***), (***atropunctata*** var. ***maritima***), ***fuscella***, ***pithodes***
- shape:
  - * discoid: ***africana***, ***baileyi***, ***dennisii***, ***kalchbrenneri***, ***marginata***, ***pruni***, ***querna***, ***repanda***, ***simplicior***

- tissue between perithecia:
  - * with carbonaceous stromatal layer discretely enclosing each perithecium: ***dennisii***, ***fuscella***
  - * with reduced carbonaceous tissue encasing individual ostioles: ***arima***, ***cinereolilacina***, ***marginata***, ***repanda***, ***simplicior***
  - * lacking carbonaceous tissue: ***bartholomaei***, ***nummularia***, ***pruni***

PERITHECIA:

- ostioles:
  - * with openings coarsely papillate: ***africana***, (***baileyi***), ***communapertura***, ***dennisii***, ***mediterranea***, ***mediterranea*** *var.* ***macrospora***, ***mediterranea*** *var.* ***microspora***, ***pithodes***, ***querna***, ***repanda***, (***reticulospora***)
  - * one ostiolar canal shared by a number of perithecia: ***communapertura***, ***plana***

ASCOSPORES:

- germ slit:
  - * absent: ***arima***, ***waitpela***
  - * less than to much less than spore-length: ***communapertura***, ***divergens***, (***pruni***), ***uniapiculata*** *var.* ***indica***, ***uniapiculata*** *var.* ***macrospora***, ***zelandica***
  - * sigmoid: ***marginata***
  - * on two sides: ***albosticta***, ***cinereolilacina***, ***querna***, ***repanda***, ***schweinitzii***
- appendage:
  - * present: ***anceps***, ***divergens***, ***doidgeae***, (***fuscella***), ***grenadensis***, ***nothofagi***, ***philippinensis***, ***philippinensis*** *var.* ***microspora***, ***pithodes***, ***plumbea***, ***uniapiculata***, ***uniapiculata*** *var.* ***indica***, ***uniapiculata*** *var.* ***macrospora***, ***waitpela***, ***weldenii***, ***weldenii*** *var.* ***microspora***, ***zelandica***
- ornamentation on epispore:
  - * reticulate: ***reticulospora***
  - * longitudinally ridged: ***sinuosa***
  - * striate: ***weldenii***, ***weldenii*** *var.* ***microspora***
- hyaline sheath:
  - * present: ***mucigera***
- color:
  - * mostly hyaline: ***anceps***
- shape:
  - * flattened: ***querna***, ***schweinitzii***
  - * conspicuously inequilateral: ***citriformis***, ***citriformis*** *var.* ***macrospora***, ***grenadensis***, ***philippinensis***, ***philippinensis*** *var.* ***microspora***, ***pithodes***, (***plumbea***), ***reticulospora***, (***uniapiculata***), ***uniapiculata*** *var.* ***indica***, ***uniapiculata*** *var.* ***macrospora***
- length (not including appendage for appendaged ascospores):
  - * less than 9 µm: ***arima***, (***communapertura***), (***mucigera***), ***waitpela***
  - * greater than 20 µm: ***atropunctata***, (***atropunctata*** *var.* ***intermedia***), (***alboticta***), (***bartholomaei***), (***capnodes*** *var.* ***rumpens***), (***dennisii***), (***mediterranea***), ***mediterranea*** *var.* ***macrospora***, ***philippinensis***,

pithodes, (***querna***), ***reticulospora***, ***sinuosa***, ***weldenii***, ***weldenii** var.* ***microspora***, (***zelandica***)

Biscogniauxia africana Y.-M. Ju & J. D. Rogers, *sp. nov.* Figs. 21 & 37

Etymology: After Africa.

Stromata elevato-discoidea, superficie plana vel leviter concava, 3.5–6 mm diam x ca. 1 mm crassa, margine distincto sordide ochraceo vel fusco e strato externo dehiscenti; superficie matura fusca; textura sub superficie et inter perithecia carbonacea; strato sub peritheciis e textura hospitis dealbata 0.5–1 mm crassa composito; textura marginis 0.3–0.4 mm crassa lignea subfusca. Perithecia tubularia, 0.1–0.2 mm diam x 0.7–0.9 mm alta. Ostiola grosse papillata. Asci 75–90 µm longitudine tota x 5.5–7 µm crassi, partibus sporiferis 65–75 µm longitudine, stipitibus ca. 10 µm longitudine, annulo apicali in liquore iodato Melzeri cyanescente, discoideo, 0.5 µm alto x 2–2.5 µm lato. Ascosporae dilute brunneae vel brunneae, unicellulares, leviter ellipsoideo-inequilaterales vel equilaterales apicibus angustatis, leves, 10–13 x 4.5–5.5 (–6) µm, rima germinativa longa recta praeditae.

Stromata raised-discoid, with plane or slightly concave surface, 3.5–6 mm diam x ca. 1 mm thick, with dirty ochraceous to dark brown, distinct raised margins originating from outer dehiscing layer; mature surface blackish brown; carbonaceous immediately beneath surface and between perithecia; layer beneath perithecia composed largely of whitened host tissue, 0.5–1 mm thick; tissue of margins 0.3–0.4 mm thick, dirty brown, woody. Perithecia tubular, 0.1–0.2 mm diam x 0.7–0.9 mm high. Ostioles higher than stromatal surface, with openings coarsely papillate. Asci 75–90 µm total length x 5.5–7 µm broad, the spore-bearing parts 65–75 µm long, the stipes ca. 10 µm long, with apical ring bluing in Melzer's iodine reagent, discoid, 0.5 µm high x 2–2.5 µm broad. Ascospores light brown to brown, unicellular, ellipsoid, slightly inequilateral to equilateral, with narrowly rounded ends, smooth, 10–13 x 4.5–5.5 (–6) µm, with straight germ slit spore-length.

Anamorph unknown.

SPECIMEN EXAMINED: UGANDA: Magomba Forest, I.1919, leg. illegible, no. 406, wood, as ***Nummularia repanda*** by Miller, J. H. (GZU-Petrak 1482, HOLOTYPE of ***Biscogniauxia africana***).

NOTES: The gross morphology is in general similar to that of ***B. repanda***. Instead of having a reduced amount of carbonaceous stromatal tissue encasing individual ostioles, ***Biscogniauxia africana*** has the stromatal interior almost entirely occupied by carbonaceous tissue. Moreover, the ascospores of ***B. africana*** do not have a bilateral germ slit. ***Biscogniauxia pruni*** has a similar ascospore morphology, but differs in having punctate ostiolar openings, in having dark brown, woody stromatal tissue inside, and in its specificity for ***Prunus***.

Biscogniauxia albosticta (Ellis & Morg.) Y.-M. Ju & J. D. Rogers, *comb. nov.* Figs. 2 & 35

≡ ***Nummularia albosticta*** Ellis & Morg., Bull. Torrey Bot. Club 24: 135. 1897.

≡ ***Hypoxylon albostictum*** (Ellis & Morg.) J. H. Miller, Mycologia 25: 325. 1933.
≡ ***Numulariola albosticta*** (Ellis & Morg.) P. Martin, J. S. African Bot. 35: 292. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 75. 1976.

Stromata applanate, 2–4 cm long x 2–3 cm broad x 1 mm thick; outer dehiscing layer dark brown, thin; mature surface blackish; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia tubular, 0.2–0.4 mm diam x 0.8–0.9 mm high. Ostioles lower than stromatal surface, with openings punctate, usually overlain with conspicuous white substance. Asci eight-spored, cylindrical, 135–155 μm total length x 10–12 μm broad, the spore-bearing parts 115–125 μm long, the stipes 15–30 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1.5–2.5 μm high x 4.5–5.5 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid, nearly equilateral, with narrowly rounded ends, smooth, 15.5–19.5 x 6.5–8.5 μm, with straight germ slit on both sides.

Anamorph unknown.

SPECIMENS EXAMINED: U.S.A.: Ohio, Preston, Morgan, A. P. 1178, decorticated wood of ***Carya*** (NY, HOLOTYPE; BPI 716055 [Lloyd herb. 11180]; GAM 2000; GZU-Petrak 2117, ISOTYPES of ***Nummularia albosticta***); Ohio, Preston, 1897, Morgan, A. P. 1200, wood of ***Carya***, as ***Nummularia leucosticta*** Ellis & Morg., *ined.* (NY); Ohio, Preston, 1895, Morgan, A. P. 218 & 219, wood of ***Carya***, as ***Nummularia leucosticta*** Ellis & Morg., *ined.* (GAM 1998 & 1999); *ex* Ellis herb., as ***Nummularia leucosticta*** Ellis & Morg., *ined.* (BPI 716054 [Lloyd herb. 11195]).

NOTES: The conspicuous white substance overlying ostiolar openings is noteworthy. In addition to ***B. albosticta***, ***Biscogniauxia cinereolilacina***, ***B. querna***, ***B. repanda***, and ***B. schweinitzii*** also have a germ slit on both sides of the ascospore.

Biscogniauxia anceps (Sacc.) J. D. Rogers, Y.-M. Ju, & Cand., Mycol. Res. 100: 669. 1996.
≡ ***Nummularia anceps*** Sacc., Bull. Orto Bot. Univers. Napoli 24: 28. 1918.

Illustrations: Rogers et al. (1996).

See Rogers et al. (1996) for descriptions and illustrations of teleomorph and anamorph. Ascospores mostly remain hyaline, 10–13 (not including appendage) x 7–9 (–10) μm, with an appendage 4–7 μm long x 4–7 μm broad. The conidiogenous structure is ***Periconiella***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: FRANCE: Landes, Château de Biaudos, 6.XII.1992, Candoussau, F., wood of ***Corylus avellana*** (JDR). HONDURAS: Zamorano, VI.1977, Rogers, J. D. & Grove, wood (JDR). ITALY: Avellino, VI.1918, no. 2727, corticated wood of ***Quercus pedunculata*** (PAD, HOLOTYPE of ***Nummularia anceps***). MEXICO: San Cristobal de las Casas municipality, El Huitepec Hill, 4.VI.1988, San Martín, F. 727, wood, as ***Biscogniauxia grenadensis*** by San Martín and Rogers (1993) (ITCV; JDR). U.K.: England, Devon, 3.V.1994, Cannon, P. F., wood of ***Corylus avellana***

(IMI 361950a). Also see Rogers et al. (1996) for data on other collections and hosts.

NOTES: ***Biscogniauxia anceps*** differs from ***B. uniapiculata*** in having abundant ascospores that remain hyaline at maturity, in having broader ascospores, i.e., 10–13 x 7–9 (–10) µm vs. (9–) 10–14 x 5–7 µm, and in having a larger cellular appendage. Both cells of the hyaline ascospore germinate in high percentages (Rogers et al., 1996).

Biscogniauxia arima San Martín, Y.-M. Ju, & J. D. Rogers, *sp. nov.*

Figs. 4, 50, & 66

Etymology: Refers to lacking of the ascospore germ slit.

Stromata applanata, 1.2 cm longa x 0.5 cm lata x 0.7 mm crassa; stratum externum dehiscens fuscum tenue; superficies matura fusca; textura proxime sub superficie carbonacea, textura inter perithecia fusca lignea, textura carbonacea omne ostiolum includens; textura sub peritheciis inconspicua. Perithecia obovoidea, 0.2–0.3 mm diam x 0.5–0.6 mm alta. Ostiola papillata. Asci 65–75 µm longitudine tota x 5–5.5 µm crassi, partibus sporiferis 55–70 µm longitudine, stipitibus 8–15 µm longitudine, annulo apicali in liquore iodato Melzeri pallida cyanescente, discoideo, 0.2 µm alto x 1.5 µm lato. Ascosporae dilutae brunneae, unicellulares, ellipsoideae fere equilaterales apicibus latis, leves, 7.5–9 x 3–4 µm, rima germinativa nulla.

Stromata applanate, 1.2 cm long x 0.5 cm broad x 0.7 mm thick; outer dehiscing layer dark brown, thin; mature surface dark brown; carbonaceous immediately beneath surface; dark brown, woody between perithecia, with carbonaceous tissue encasing each individual ostiole; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.2–0.3 mm diam x 0.5–0.6 mm high. Ostioles higher than stromatal surface, with openings papillate. Asci 65–75 µm total length x 5–5.5 µm broad, the spore-bearing parts 55–70 µm long, the stipes 8–15 µm long, with apical ring lightly bluing in Melzer's iodine reagent, discoid, 0.2 µm high x 1.5 µm broad. Ascospores light brown, unicellular, ellipsoid, nearly equilateral, with broadly rounded ends, smooth, 7.5–9 x 3–4 µm, lacking germ slit.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light not reaching the edge of 9 cm Petri dish, at first white, felty, azonate, with diffuse margins, becoming blackish from center outwards. Reverse grayish sepia (106). Sporulating regions scattered over entire surface of colony, smoke gray (105). Conidiogenous structure with ***Nodulisporium***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores pale brown, slightly roughened, di- or trichotomously branched, sometimes with additional branches arising from the first level of conidiogenous regions, 4–5 µm diam, with two to three conidiogenous cells arising from each terminus. Conidiogenous cells cylindrical, hyaline, smooth, 15–26 x 3–4 µm, bearing somewhat denticulate conidial secession scars on apical region, frequently elongated from the apical region to form rachis after producing one to several conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid to short cylindrical, 4.5–8 x 2.5–3 µm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: MEXICO: San Luis Potosí State, 15 km Valles City-Tampico Rd., Taninul Hotel, 8.VIII.1995, San Martín, F. 8010S (CULTURED), wood (ITCV, HOLOTYPE; WSP, ISOTYPE of ***Biscogniauxia arima***).

NOTES: Ostioles of this fungus are individually encased by carbonaceous tissue. This phenomenon can also be observed in ***B. cinereolilacina***, ***B. marginata***, ***B. repanda***, and ***B. simplicior***. The present fungus differs from these latter species in having smaller ascospores that apparently lack a germ slit.

Biscogniauxia atropunctata (Schwein.: Fr.) Pouzar, Česká Mykol. 33: 216. 1979. Fig. 68

≡ ***Sphaeria atropunctata*** Schwein., Schrift. Naturf.-Ges. Leipzig I, p. 31. 1822; Schwein.: Fr., Syst. Mycol. II, p. 351. 1823.

≡ ***Diatrype atropunctata*** (Schwein.: Fr.) Berk., Trans. Linn. Soc. 22: 269. 1858.

≡ ***Anthostoma atropunctatum*** (Schwein.: Fr.) Sacc., Syll. Fung. I, p. 295. 1882.

≡ ***Hypoxylon atropunctatum*** (Schwein.: Fr.) Cooke, Grevillea 11: 138. 1883.

≡ ***Nummularia atropunctata*** (Schwein.: Fr.) Höhn., Ann. Mycol. 16: 219. 1918.

≡ ***Numulariola atropunctata*** (Schwein.: Fr.) House, New York State Mus. Bull. 266: 49. 1925.

≡ ***Albocrustum atropunctatum*** (Schwein.: Fr.) C. G. Lloyd, Mycol. Writings 7: 1353. 1925.

= ***Nummularia cinerea*** Rehm, Ascom. Exs. fasc.56, no. 2150. 1918; *non* Pat., 1895; [*nom. rejic.*, ICBN Art. 53.1].

Illustrations: Miller (1961, Figs. 186 & 220) [as ***Hypoxylon atropunctatum***].

Stromata applanate, 2–50(+) cm long x 2–25(+) cm broad x 0.4–0.7 mm thick; outer dehiscing layer white, becoming blackish, thin; mature surface white, with black ostioles, eventually becoming almost entirely black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.2–0.3 mm diam x 0.3–0.5 mm high. Ostioles slightly higher than the stromatal surface, with openings papillate. Asci 150–170 µm total length x 16–18 µm broad, the spore-bearing parts 140–155 µm long, the stipes 10–20 µm long, with apical ring bluing in Melzer's iodine reagent, discoid, 4–5.5 µm high x 7–8 µm broad. Ascospores brown to dark brown, unicellular, ellipsoid, nearly equilateral, with narrowly rounded ends, smooth, (20–) 23–30 x 11.5–14.5 µm, with straight germ slit spore-length.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 1 wk, at first white, felty, azonate, with diffuse and ropy margins, becoming floccose, with greenish olivaceous (90) or dull green (70) patches. Reverse dull green (70) or greenish olivaceous (90). Sporulating regions scattered over entire surface of colony, whitish. Conidiogenous structure with branching pattern varying from ***Nodulisporium***-like to ***Periconiella***-like as defined in Ju and Rogers (1996). Conidiophores hyaline to yellowish, smooth, frequently borne on aerial hyphae, composed of a short main axis, 2.5–4 μm broad, and sometimes one or more major branches, the branches terminating with two to three conidiogenous cells arising in whorls from the main axis and/or from major branches; additional branches infrequently produced. Conidiogenous cells ovate to short cylindrical, hyaline, smooth, 5–10 x 3.5–4.5 μm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, globose to subglobose, 4–5.5 x 3–4.5 μm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: MEXICO: Nuevo León State, Iturbide Municipality, Ejido La Purísima. 2000 m elev., no date, Marmolejo 185, wood of ***Quercus*** (ITCV; JDR). U.S.A.: Florida, Orlando, 19.II.1938, Shear, C. L., wood of ***Quercus***, as ***Nummularia atropunctata*** by Petrak, F. (WSP 32319); North Carolina, Salem & Pennsylvania, Bethlehem, Syn. 1232, wood (PH, HOLOTYPE of ***Sphaeria atropunctata***); North Carolina, Grand, L. F., (CULTURED), wood (JDR); North Dakota, Kulm, 2.1915, Brenckle, J. F., Rehm's Ascomyc. Exs. 2150, wood (S, HOLOTYPE of ***Nummularia cinerea***); Ohio, Logan Co., Indian Lake State Park, 16.V.1970, Cooke, W. B. & V. G. 42150, wood of ***Quercus bicolor***, as ***Hypoxylon atropunctatum*** (WSP 59390); Virginia, Fauquier Co., Vint Hill Farms, 6.III.1945, Cooke, W. B., Mycobiota of North America 163, wood of ***Quercus velutinus***, as ***Nummularia bulliardi*** (WSP 21285).

NOTES: ***Biscogniauxia atropunctata*** and its small-spored varieties, ***intermedia*** and ***maritima***, are readily recognized by their white mature stromatal surfaces with black ostioles. The former is exceedingly common on ***Quercus*** species in southeastern United States.

Cultures and anamorph have been described by Martin (1969) on 2% malt agar. The conidiogenous structure that we describe herein is in accordance with his description.

Biscogniauxia atropunctata (Schwein.: Fr.) Pouzar *var.* ***intermedia*** Y.-M. Ju, J. D. Rogers, & San Martín, *var. nov.* Fig. 69

A varietate typica differt in ascosporis 16–22 x 7.5–11 μm.

Differs from the typical variety in ascospores 16–22 x 7.5–11 μm.

Cultures and anamorph are like those of the typical variety except for frequently having ellipsoid conidia 5–11 x 3.5–4.5 μm.

SPECIMENS EXAMINED: COSTA RICA: Guanacaste, Santa Rosa, 12.VI.1995, Lodge, D. J. & Bills, G., CR-491 (CULTURED), bark of fallen tree (WSP, HOLOTYPE of ***Biscogniauxia atropunctata*** *var.* ***intermedia***). MEXICO: Tamaulipas State, Casas Municipality, El Lajcadero Ranch, 8.X.1986, José Castillo 1100B, wood of ***Quercus***, as ***Biscogniauxia*** *sp.* José Castillo 1100B by San Martín and Rogers (1993) (ITCV; JDR).

Biscogniauxia atropunctata (Schwein.: Fr.) Pouzar *var.* ***maritima*** (Lar. N. Vasilyeva) Y.-M. Ju & J. D. Rogers, *comb. nov.*

≡ ***Biscogniauxia maritima*** Lar. N. Vasilyeva, Mikologiya i Fitopatologiya 22: 393. 1988.

The teleomorph is much like that of the typical variety except for having a smaller ascospore size range, 12–15.5 x 7–8 μm.

SPECIMENS EXAMINED: RUSSIA: Primorsky Territory, reserve Sikhote-Alin, 24.VIII.1985, Vasilyeva, L. N., wood of ***Quercus mongolica*** (VLA, HOLOTYPE of ***Biscogniauxia maritima***); Primorsky Territory, reserve Ussurisky, 1.VI.1989, Vasilyeva, L. N., wood of ***Quercus mongolica***, as ***Biscogniauxia maritima*** (VLA).

Biscogniauxia baileyi (Berk. & Broome *ex* Cooke) Kuntze, Rev. Gen. Plant. 2: 398. 1891. Fig. 20

≡ ***Nummularia baileyi*** Berk. & Broome *ex* Cooke, Grevillea 12: 6. 1883.

Stromata raised-discoid, with concave surface, 4–5 mm diam x 1.5 mm thick, with dark brown, distinct raised margins originating from outer dehiscing layer; mature surface blackish; tissue immediately beneath surface and between perithecia undetermined; tissue beneath perithecia composed largely of host tissue; tissue of margins 0.2 mm thick, carbonaceous, extending downwards into substrate. Perithecia tubular, 0.1–0.3 mm diam x 1 mm high. Ostioles higher than stromatal surface, with openings papillate to coarsely papillate. Asci not observed. Ascospores dark brown, unicellular, subglobose to ellipsoid, equilateral, with broadly to, infrequently, narrowly rounded ends, smooth, 14–16.5 x 9.5–11.5 μm, with straight germ slit spore-length.

Anamorph unknown.

SPECIMENS EXAMINED: AUSTRALIA: Bancroft 428, decorticated wood (K 36391, HOLOTYPE of ***Nummularia baileyi***); Sydney, Cleland, J. B., decorticated wood, *ex* Lloyd herb., as ***Nummularia baileyi*** (GZU-Petrak 2118).

NOTES: This species is known only from Australia. The gross morphology is highly similar to that of ***B. marginata*** from which it differs in having a straight rather than sigmoid germ slit. ***Biscogniauxia dennisii*** is a closely related species, but it differs in having larger perithecia and in having larger ascospores. We were unable to determine the composition and configuration of the stromatal tissue that is located immediately beneath the surface and between perithecia because the specimens that we have examined are overmature and depauperate. ***Biscogniauxia baileyi*** might represent the Southern Hemisphere equivalent of ***B. marginata***. The latter is fairly specific for rosaceous hosts; host relationships of the former are unknown.

Biscogniauxia bartholomaei (Peck) Lar. N. Vasilyeva, Mikologiya i Fitopatologiya 22: 392. 1988. Fig. 65

≡ ***Hypoxylon bartholomaei*** Peck, New York State Mus. Bull. 150: 56. 1911.

≡ ***Numulariola bartholomaei*** (Peck) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.
≡ ***Nummularia bartholomaei*** (Peck) Lar. N. Vasilyeva, Pirenomitsety i Lokuloaskomitsety Severa Dal'nego Vostoka, Leningrad, p. 214. 1987.

Illustrations: Miller (1961, Figs. 192 & 225) [as ***Hypoxylon bartholomaei***].

Stromata applanate, 0.8–3 cm long x 0.4–1.1 cm broad x 0.6–0.8 mm thick; outer dehiscing layer dark brown, thin; mature surface dark gray to blackish brown; carbonaceous immediately beneath surface; tissue between perithecia fibrous to woody, gray, becoming dark brown; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.3–0.4 mm diam x 0.5–0.6 mm high. Ostioles lower than stromatal surface, with openings punctate. Asci 180–200 µm total length x 11–13 µm broad, the spore-bearing parts 145–160 µm long, the stipes 25–35 µm long, with apical ring bluing in Melzer's iodine reagent, discoid, 2.5–3.5 µm high x 5.5–7 µm broad. Ascospores dark brown, unicellular, ellipsoid, equilateral to slightly inequilateral, with narrowly rounded ends, smooth, 17.5–22 (–25) x (8–) 9–11 (–12) µm, with straight germ slit spore-length.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 3 wk, at first white, felty, azonate, with diffuse margins, becoming hazel (88), overlain with amber (47) or honey (64) patches. Reverse uncolored. Sporulating regions scattered over entire surface of colony, whitish. Conidiogenous structure close to ***Virgariella***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores hyaline, coarsely roughened, unbranched or dichotomously branched, usually with additional branches arising from the first level of conidiogenous regions, 3.5–4.5 µm broad, with one or two conidiogenous cells arising from each terminus. Conidiogenous cells cylindrical, hyaline, finely roughened, 18–27 x 3–3.5 µm, bearing poroid conidial secession scars on apical region. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid to short cylindrical, 6–10 x 3–4 µm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: CANADA: Vancouver Island, Metchosin, 15.IV.1995, Callan, B., (CULTURED), decorticated wood of ***Alnus rubra*** (JDR, *ex* DAVFP 25111). U.S.A.: Washington, Rolling Bay, 25.VIII.1909, Bartholomew, E. 4189, decorticated wood of ***Alnus rubra*** (NYS, HOLOTYPE of ***Hypoxylon bartholomaei***); Washington, Kitsap Co., Bainbridge Island, 26.VIII.1909, Bartholomew, E., Fung. Columb. Ex. 3332, decorticated wood of ***Alnus rubra***, as ***Hypoxylon bartholomaei*** (BPI-CLS; WSP 3203); Washington, Sequim, 22.VII.1901, Lawrence, W. H. 89, decorticated wood of ***Populus trichocarpa***, as ***Hypoxylon mediterraneum*** (WSP 47693).

NOTES: This rarely-collected fungus is mainly distributed in the Pacific Northwest. Recently, Vasilyeva (1988) reported it from the Far East. ***Biscogniauxia bartholomaei*** and ***B. nummularia*** are similar in having grayish brown or dark brown, woody stromatal tissue between perithecia. They differ mainly in their ascospore sizes and anamorphs. Moreover,

Biscogniauxia nummularia is primarily an European species. The conidiogenous structure is in general ***Virgariella***-like as defined by Ju and Rogers (1996) but deviates from the typical pattern in having more robust conidiophores.

Biscogniauxia capnodes (Berk.) Y.-M. Ju & J. D. Rogers, *comb. nov.*
Figs. 31, 39, & 60

≡ ***Sphaeria capnodes*** Berk., Hooker's London J. Bot. 4: 72. 1845.
≡ ***Diatrype capnodes*** (Berk.) Curr., Trans. Linn. Soc. 22: Tab. 46, Fig. 73. 1858.
≡ ***Anthostoma capnodes*** (Berk.) Sacc., Syll. Fung. I, p. 298. 1882.
≡ ***Hypoxylon capnodes*** (Berk.) Berk. & Broome *ex* Cooke, Grevillea 11; 133. 1883.
= ***Sphaeria pachyloma*** Lév., Ann. Sci. Nat., Bot. III, 5: 259. 1846.
    ≡ ***Hypoxylon pachyloma*** (Lév.) Mont. *ex* Speg., An. Soc. Cient. Argent. 12: no. 132. 1881.
    ≡ ***Nummularia pachyloma*** (Lév.) Cooke, Grevillea 12: 8. 1883.
= ***Hypoxylon ramosum*** Schwein. *ex* Cooke, Grevillea 11: 132. 1883.
= ***Nummularia mauritanica*** Berk. & Cooke *apud* Cooke, Grevillea 12: 6. 1883.
= ***Hypoxylon intermedium*** Speg., An. Soc. Cient. Argent. 18: 274. 1884; *non* (Schwein.: Fr.) Y.-M. Ju & J. D. Rogers, 1996; [*nom. rejic.*, Art. 13.1 (d)].
= ***Hypoxylon pseudopachyloma*** Speg., Bol. Acad. Nac. Cienc. Cordoba 11: 203. 1887.
    ≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***pseudopachyloma*** (Speg.) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 125. 1961.
    ≡ ***Numulariola pseudopachyloma*** (Speg.) P. Martin, J. S. African Bot. 35: 306. 1969.
    ≡ ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze *var.* ***pseudopachyloma*** (Speg.) Whalley *apud* Whalley, Hywel-Jones, Jones, & Whalley, Sydowia 47: 73. 1995.
= ***Nummularia lataniaecola*** Rehm & Bref. *apud* Bref., Unters. Mykol. X, p. 255. 1891.
= ***Nummularia tenuis*** Starb., Arkiv. fur. Bot. 5: 31. 1905; *non* Pass., 1875; [*nom. rejic.*, Art. 53.1].
    ≡ ***Nummularia starbaeckii*** Sacc. & Traverso *apud* Sacc., Syll. Fung. XX, p. 203. 1911.
= ***Auerswaldia maxima*** Massee, Kew Bull. 1901: 166. 1901.
    ≡ ***Nummularia maxima*** (Massee) Theiss. & Syd., Ann. Mycol. 12: 179. 1914.
= ***Nummularia asarcodes*** Theiss., Ann. Mycol. 6: 349. 1908.
    ≡ ***Hypoxylon asarcodes*** (Theiss.) J. H. Miller *ex* S. Teng, A Contribution to Our Knowledge of the Higher Fungi of China, p. 127. 1939.
= ***Nummularia bulliardi*** Tul. & C. Tul. *var.* ***stenosperma*** Theiss., Ann. Mycol. 6: 530. 1908.
= ***Nummularia asarcodes*** Theiss. *f.* ***griseoatra*** Theiss., Decades Fungorum Brasiliensium, nos. 84 & 110. 1910.

= ***Nummularia merrillii*** Bres., Hedwigia 56: 307. 1915.

≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***merrillii*** (Bres.) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 126. 1961.

≡ ***Numulariola merrillii*** (Bres.) P. Martin, J. S. African Bot. 35: 303. 1969.

≡ ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze *var.* ***merrillii*** (Bres.) Van der Gucht, Mycotaxon 45: 267. 1992.

= ***Nummularia alabatensis*** Yates, Philipp. J. Sci. 12: 378. 1917.

= ***Hypoxylon porteri*** Speg., Bol. Acad. Nac. Ci. 25: 54. 1921.

Stromata applanate, 0.5–13 cm long x 0.5–5 cm broad x 0.5–1 mm thick; outer dehiscing layer dark brown, thin; mature surface blackish; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid to tubular, 0.2–0.4 mm diam x 0.4–0.8 mm high. Ostioles slightly higher than stromatal surface with openings slightly papillate, or lower than stromatal surface with openings punctate and usually surrounded by slightly raised rim, sometimes overlain with white substance. Asci 70–115 μm total length x 7–10 μm broad, the spore-bearing parts 60–95 μm long, the stipes 10–30 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1.5–4 μm high x 3.5–4 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid, nearly equilateral, with narrowly to, less frequently, broadly rounded ends, smooth, 8.5–15 x 5–7.5 μm, with straight germ slit spore-length.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 1–1.5 wk, at first white, felty, azonate, with diffuse and ropy margins, becoming honey (64), hazel (88), or greenish olivaceous (90) from center outwards. Reverse citrine (13) or greenish olivaceous (90), becoming olivaceous black (108). Sporulating regions scattered over entire surface of colony, whitish to grayish. Conidiogenous structure with ***Periconiella***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores yellowish to brownish, coarsely roughened, composed of a main axis, 3–5 μm broad, and sometimes one or more major branches, branches terminating with three to seven conidiogenous cells arising in whorls from the main axis and/or from major branches or from additional subordinate branches; additional branches infrequently produced. Conidiogenous cells cylindrical, hyaline to yellowish, finely roughened, 8–14 x 3.5–5 μm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid, 5–7.5 x 2.5–3.3 μm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: ARGENTINA: Tierra del Fuego, Slogget-Bay, Isla de los Estados, 1882, Spegazzini, C., wood of ***Fagus*** [probably ***Nothofagus***] (LPS 1963 [3 pts.], HOLOTYPE; BPI-CLS, ISOTYPE of ***Hypoxylon pseudopachyloma***); Prov. Jujuy, pr. Laguna de la Brea, 16.VI.1901, Fries, R. E. 74, corticated wood (S, HOLOTYPE of ***Nummularia tenuis***). AUSTRALIA: Swan River, Drummond 218, decorticated wood (K, HOLOTYPE of ***Sphaeria capnodes***); Tasmania, Arthur River, 27.X.1975, Kile, G. A., DAR 30167, sent by Whalley, A. J. S., corticated wood of ***Nothofagus cunninghamii*** (JDR); Tasmania, Smithton, Sumac Rd., II.1979, Kile, G. A., branches of ***Nothofagus cunninghamii*** (JDR [2 pks.]). BRAZIL: Rio Grande do Sul, São Leopoldo, 1908, Theissen, F., *ex* Rick, J., corticated wood (GAM 2035 & 2037, TYPES of ***Nummularia asarcodes***); 1908, Rick, J., *ex* Lloyd herb., wood, as ***Nummularia asarcodes*** (GZU-Petrak 2113); São Leopoldo, 1906, Theissen, F., Rick's Fungi Austro-Americani 312, wood, as ***Nummularia asarcodes*** (BPI 587852; FH), overmature, no spores found; Rio Grande do Sul, São Leopoldo, 1907, Theissen, F., Decades Fungorum Brasiliensium 84, wood (BPI 587870; GZU-Petrak 1426, SYNTYPES of ***Nummularia asarcodes*** *f.* ***griseoatra***); Rio Grande do Sul, São Leopoldo, 1907, Theissen, F., Decades Fungorum Brasiliensium 110, wood (BPI 587872, SYNTYPE of ***Nummularia asarcodes*** *f.* ***griseoatra***); Theissen, F., corticated wood (FH, TYPE of ***Nummularia bulliardi*** *var.* ***stenosperma***); Viçosa, Universidade Federalde, Ferreira, F. A., corticated wood of ***Eucalyptus*** (JDR); Rick, J., corticated wood, as ***Hypoxylon papyraceum*** by Miller, J. H. (BPI 716609, 716610, 716611, 716615, & 716616 [Lloyd herb. 10577, 12789, 10563, 12836, & 11606]). CHILE: Gay, C., corticated wood (PC, LECTOTYPE [selected by Ju and Rogers (1996)] of ***Sphaeria pachyloma***); Los Perales, 1917, Spegazzini, C. 1967, wood of ***Quillaja saponaria*** (LPS, HOLOTYPE [empty packet]; BPI, ISOTYPE of ***Hypoxylon porteri***). GERMANY: Münster, XI.1889, Tavel, F. V. 237, fronds of ***Latania*** (S, HOLOTYPE of ***Nummularia lataniaecola***). GHANA: Gold Coast, Aburi, Botanical Gardens, Johnson 58, wood (K 36388, HOLOTYPE of ***Auerswaldia maxima***). JAPAN: Bonin Islands, 10.IX.1918, Yasuda, A., wood, as ***Hypoxylon papyraceum*** by Miller, J. H. (BPI 716612 [Lloyd herb. 11691]). MAURITIUS: Mt. Pouce, IV.1857, Fungus no. 16, wood (K, HOLOTYPE of ***Nummularia mauritanica***). MEXICO: Nuevo León State, Santiago Municipality, El Cercado, 23.X.1988, San Martín, F. 1142, wood (ITCV; JDR); Tamaulipas State, Hidalgo Municipality, Ejido Conrado Castillo, VII.1987, San Martin, F. 453, wood of ***Quercus*** (ITCV; JDR). NEW ZEALAND: Mid Canterbury, vic. Springfield, 5.V.1995, Johnston, P. R., (CULTURED), dead wood of ***Nothofagus solandri*** (JDR); Mid Canterbury, Mt. Thomas, 4.V.1995, Johnston, P. R., dead wood of ***Nothofagus solandri*** (JDR); N. Canterbury, vic. Cheviot, 2.V.1995, Johnston, P. R., dead wood of ***Nothofagus solandri*** (JDR). PARAGUAY: Guarapi, VII.1881, Balansa, B. 2728, wood (BPI-CLS, ISOTYPE of ***Hypoxylon intermedium***). PHILIPPINES: Negros, Canlaon Volcano, 1910, Merrill, E. D. 6896, wood (GZU-Petrak 1461 & 2133; K; S, TYPES of ***Nummularia merrillii***); Alabat Island, 21–30.XII.1916, Merrill, E. D. 10515, corticated wood (BPI 587515; GZU-Petrak; K, TYPES of ***Nummularia alabatensis***). TAIWAN: Taipei Co., Wu-lai, 15.V.1988, Ju, Y.-M. 77051502, dead wood (JDR; NTU); Taipei City, Young-ming-shan, 8.I.1988, Chang, T.-M. 77010804, corticated wood (JDR; NTU); Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M. 77031509 (CULTURED), corticated wood (JDR; NTU); Tai-Tung City, Lee-yu-shan, 21.V.1988, Hsieh, H.-M. 77052103 (CULTURED), corticated twigs of ***Leucaena glauca*** (JDR; NTU); Tai-nan Co., Hsin-hwa, 16.VII.1988, Hsieh, H.-M. 77071604 (CULTURED), corticated wood (JDR; NTU); Nan-tou Co., Lu-ku, Shi-tou, 2.XI.1987, Ju, Y.-M. 76110201 (CULTURED), dead wood (JDR; NTU). U.S.A.: California, Humboldt Co., Trinidad, Spruce Cove, 14.I.1944, Parks, H. E. 6694, twigs of ***Rubus spectabilis***, as ***Nummularia bulliardi*** (WSP 39983); California, Humboldt Co., Trinidad, Spruce Cove, III.1952, Parks, H. E. 7544, California fungi 792, as ***Nummularia bulliardi*** (WSP 39021); Hawaii, Hawaiian Fungi 7, wood, as ***Nummularia guaranitica*** (S); Hawaii, Hilo, IX.1989, Ko, W. 208F, corticated wood of ***Macadamia*** (JDR); Hawaiian Islands, Honolulu, 29.XII.1908, Forbes, C. N. 22, corticated wood, as ***Hypoxylon papyraceum*** by Miller, J. H. (BPI 716614 [Lloyd herb. 11021]); Hawaiian Islands, Hawaii, Bird Park, 28.II.1996, Hemmes, D. DEH-1042, wood of ***Acacia koa*** (JDR); Hawaiian Islands, Kauai, Kokee Park, 9.I.1996, Rogers, J. D., (CULTURED), wood of ***Metrosideros polymorpha*** (JDR); Hawaiian Islands, Molokai, Kamachou Reserve, 12.I.1996, Rogers, J. D., (CULTURED), wood of ***Eucalyptus*** (JDR); Hawaiian Islands, Oahu, Kailua, 30.XII.1939, Heggenen & Akamine 221, wood of ***Metrosiderus polymorpha*** (BISH 145873); Indiana, corticated wood, as ***Sphaeria ramosa*** Fr. by Schweinitz, L. V. D. (PH, ISOTYPE of ***Hypoxylon ramosum***); Louisiana, West Feliciana Parish, IV.1980, Rogers, J. D. & Jones, J. P., wood of ***Platanus occidentalis*** (JDR); Louisiana, vic. of New Orleans, VI.1976, Rogers, J. D., corticated wood of ***Acer*** (JDR).

NOTES: ***Biscogniauxia capnodes*** is the most commonly encountered taxon of the genus. Our concept of ***B. capnodes*** embraces *var.* ***exutans*** (Cooke) J. H. Miller, *var.* ***merrillii*** (Bres.) J. H. Miller, and *var.* ***pseudopachyloma*** (Speg.) J. H. Miller of ***Hypoxylon nummularium*** Bull.: Fr. [≡ ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze] in Miller (1961). We do not consider these varieties as recognized by Miller (1961) to be separate taxa. It is worth mentioning that Miller (1961) misinterpreted the type of *var.* ***exutans*** which is possibly a synonym of ***B. fuscella*** (see NOTES on ***B. fuscella***). Miller (1961) separated these varieties largely on small differences in ascospore size ranges and, to a lesser extent, on ascospore shape. Cultures from collections with ascospores falling into different size ranges do not appear to differ. Moreover, delimiting ascospores of various collections into size ranges given by Miller (1961) is difficult and can be done only for a few collections. It appears to us that ***B. capnodes*** is a species distinct from ***B. nummularia***. They can be easily separated by stromatal anatomy and ascospore shape. ***Biscogniauxia capnodes*** has carbonaceous tissue between perithecia and ellipsoid ascospores, whereas ***B. nummularia*** has gray to brown, woody tissue between perithecia and more rounded ascospores. Geographically, ***Biscogniauxia nummularia*** is largely confined in Europe, whereas ***B. capnodes*** has apparently been infrequently collected in Europe. See Ju and Rogers (1996) for comments on the type of ***Hypoxylon porteri***.

Biscogniauxia capnodes (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***limoniispora*** Y.-M. Ju & J. D. Rogers, *var. nov.* Fig. 41

Etymology: Refers to the lemon-shaped ascospores.

A varietate typica differt in ascosporis fuscis lemoniformibus 11.5–14 x 6–7.5 μm.

Differs from the typical variety in blackish brown, lemon-shaped ascospores, 11.5–14 x 6–7.5 µm.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 1 wk, at first white, felty, azonate, with diffuse and ropy margins, becoming fawn (87). Reverse citrine (13) or greenish olivaceous (90), becoming olivaceous black (108). Sporulating regions, conidiogenous structure, conidiophores, conidiogenous cells, and conidia are much as those of the typical variety.

SPECIMEN EXAMINED: THAILAND: Khao Yai Nakorn Nayok, 29.X.1994, Bandoni, R. J. & A. A., & Flegel, T. W. 11063 (CULTURED), corticated wood (WSP, HOLOTYPE of ***Biscogniauxia capnodes*** *var.* ***limoniispora***).

NOTES: Ascospores of ***B. citriformis*** and its variety, ***macrospora***, are somewhat lemon-shaped, but, unlike those of ***B. capnodes*** *var.* ***limoniispora***, they are strongly inequilateral and often somewhat "C"-shaped.

Biscogniauxia capnodes (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers, *comb. nov.*

≡ ***Diatrype rumpens*** Cooke, J. Linn. Soc., Bot. 17: 143. 1878.

≡ ***Anthostoma rumpens*** (Cooke) Sacc., Syll. Fung. I, p. 306. 1882.

≡ ***Nummularia rumpens*** (Cooke) Cooke, Grevillea 12: 8. 1883.

≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***rumpens*** (Cooke) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 123. 1961.

≡ ***Numulariola rumpens*** (Cooke) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

= ***Nummularia australis*** Cooke, Grevillea 11: 148. 1883.

≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***australe*** (Cooke) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 123. 1961.

≡ ***Numulariola australis*** (Cooke) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.

= ***Nummularia clypeus*** (Schwein.) Cooke *var.* ***macrospora*** Theiss., Ann. Mycol. 6: 349. 1908.

= ***Nummularia lianae*** Rehm, Leafl. Philipp. Bot. 8: 2959. 1916.

The teleomorph is much like that of the typical variety except for having a larger ascospore size range, (14–) 15–22.5 (–24) x 8–11 (–12) µm.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 1 wk, at first white, felty, azonate, with diffuse and ropy margins, becoming unevenly mixing with citrine (13) and pure yellow (14). Reverse citrine (13) or greenish olivaceous (90), becoming olivaceous black (108). Sporulating regions, conidiogenous structure, conidiophores, conidiogenous cells, and conidia are much as those of the typical variety.

SPECIMENS EXAMINED: AUSTRALIA: Clarence River, Thorneton, wood (K, HOLOTYPE of ***Nummularia australis***). BRAZIL: Rio Grande do Sul, São Leopoldo, Theissen, F., corticated wood (GAM 12824, TYPE of ***Nummularia clypeus*** *var.* ***macrospora***). CHINA: Hainan, Tan-hsien, 29.IX.1934, Deng, S. Q. 4874, wood, as ***Nummularia clypeus*** *var.*

macrospora by Teng, S. C. (BPI 595041). INDIA: Uttar Pradesh, Mussorie, Jabar Khet, 28.VIII.1973, Dargan, J. S., Panjab 13144, corticated wood (JDR). MADAGASCAR: Andasibe, 19.VII.1981, Gilles, G., sent by Candoussau, F. as MAD 182, corticated wood (JDR). PHILIPPINES: Mt. Maquiling, 7.III.1914, Baker, C. F. 2881, dead liana (S, HOLOTYPE of ***Nummularia lianae***). TAIWAN: I-lan Co., Ta-tung, Chi-lan-shan, 11.X.1996, Ju, Y.-M. 85101103 (CULTURED), wood (JDR). U.S.A.: Hawaii, XI.1980, Ko, W., wood of ***Macadamia*** (JDR); Hawaiian Islands, Kauai, Kokee Park, 8.I.1996, Gilbertson, R. L. 21118 (CULTURED), wood of ***Acacia koa*** (JDR); Louisiana, St. Martinsville, 6.XII.1895, Langlois, A. B., twigs of ***Berchemia***, as ***Nummularia rumpens*** (GZU-Petrak 1488); Louisiana, 28.III.1890, Langlois, A. B., wood, as ***Nummularia rumpens*** (GZU-Petrak 1487); Texas, Galveston Bay, Ravenel, H. W. 63, bark (K, HOLOTYPE of ***Diatrype rumpens***).

NOTES: This fungus is a large-spored variety of ***B. capnodes***. Miller (1961) recognized *var.* ***australe*** (Cooke) J. H. Miller and *var.* ***rumpens*** (Cooke) J. H. Miller as two distinct varieties of ***Hypoxylon nummularium*** Bull.: Fr. [≡ ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze]. However, he did not distinguish these two varieties unequivocally. The ascospore size ranges that he gave for these two varieties are largely overlapping: 14–24 x 8–14 μm for *var.* ***australe*** and 14–20 x 9–12 μm for *var.* ***rumpens***. We therefore consider them to be convarietal. Miller (1961) treated ***Hypoxylon ellipticum*** Cooke & Massee and ***Nummularia anthracodes*** (Fr.: Fr.) Cooke *var.* ***gliricidiae*** Rehm as synonyms of ***H. nummularium*** *var.* ***australe***. ***Hypoxylon ellipticum*** is a different ***Biscogniauxia*** (see the entry "***pusilla***" in LIST OF NAMES herein), whereas ***N. anthracodes*** *var.* ***gliricidiae*** is ***Camillea tinctor*** (Berk.) Laessøe, J. D. Rogers, & Whalley (Ju and Rogers, 1996).

Biscogniauxia capnodes (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***theissenii*** (Syd. & P. Syd.) Y.-M. Ju & J. D. Rogers, *comb. nov.* Fig. 40

≡ ***Nummularia theissenii*** Syd. & P. Syd., Ann. Mycol. 7: 344. 1909.

≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***theissenii*** (Syd. & P. Syd.) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 124. 1961.

≡ ***Numulariola theissenii*** (Syd. & P. Syd.) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 79. 1976.

The teleomorph is much like that of the typical variety except for having light brown, narrow ascospores, 9.5–13.5 x 4.5–5 μm.

Anamorph unknown.

SPECIMENS EXAMINED: BRAZIL: São Leopoldo, 1907, Theissen, F., wood (S, HOLOTYPE of ***Nummularia theissenii***); São Leopoldo, 1907, Rick, J., Fung. Austro.-Amer. 222, bark, as ***Nummularia glycyrrhizae*** (GZU-Petrak 1450).

NOTES: The ascospore size range given by Miller (1961) [as ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***theissenii*** (Syd. & P. Syd.) J. H. Miller] is larger than ours, i.e., 12–18 x 5–6.5 μm vs. 9.5–13.5 x 4.5–5 μm. His measurements were apparently based on ascospores of a Thaxter specimen from South America.

Biscogniauxia cinereolilacina (J. H. Miller) Pouzar, Česká Mykol. 33: 216. 1979. Fig. 36
≡ ***Hypoxylon cinereolilacinum*** J. H. Miller, Mycologia 25: 324. 1933.
≡ ***Numulariola cinereolilacina*** (J. H. Miller) P. Martin, J. S. African Bot. 35: 292. 1969; [*nom. inval.*, ICBN Art. 33.2]; as "***cineraceo-lilacinum***"; J. S. African Bot. 42: 76. 1976.
= ***Nummularia bulliardi*** Tul. & C. Tul. *f.* ***tiliae*** Rehm, Ascomyceten, fasc. 20, no. 977. 1889.
= ***Nummularia anthracina*** (Schmidt) Traverso *var.* ***tiliaecola*** Rehm, Ann. Mycol. 7: 532. 1909.

Illustrations: Miller (1961, Figs. 77 & 88) [as ***Hypoxylon cinereolilacinum***].

Stromata applanate, 1.5–10.5 cm long x 0.4–3 cm broad x 0.6–0.7 mm thick; outer dehiscing layer dark brown, thin; surface dull purplish brown when young, mouse gray when mature; dark brown, woody immediately beneath surface and between perithecia, with carbonaceous tissue encasing each individual ostiole; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.2–0.4 mm diam x 0.4–0.5 mm high. Ostioles higher than stromatal surface, with openings papillate. Asci 100–130 µm total length x 7.5–10 µm broad, the spore-bearing parts 70–110 µm long, the stipes 10–30 µm long, with apical ring lightly bluing or not bluing in Melzer's iodine reagent, discoid, 1 µm high x 3–4 µm broad. Ascospores light brown to brown, unicellular, ellipsoid, nearly equilateral, with broadly rounded ends, smooth, 12–16 (–17.5) x (4.5–) 5.5–7 µm, with straight germ slit spore-length on both sides.

Cultures and anamorph have been described and illustrated by Granmo and Petrini (1996) on malt agar. The conidiogenous structure that they described is ***Periconiella***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: CANADA: London, I.1894, Dearness, J., Fung. Columb. 241, ***Tilia***, as ***Hypoxylon atropurpureum*** by Ellis, J. B. (BPI; WSP 3200). FRANCE: Hautes Pyrénées, Luz St. Sauveur 65, 27.IX.1987, Candoussau, F. 5250, corticated wood of ***Tilia*** (JDR). HUNGARY: Pressburg, 1888, Bäumler, Rehm's Ascom. Exs. 977, bark of ***Tilia*** (BPI, TYPE of ***Nummularia bulliardi*** *f.* ***tiliae***). NORWAY: Sogn og Fjordane, Sogndal, Stedje, 29.VII.1995, Granmo, A. 196/95, ***Tilia cordata*** (TROM). U.S.A.: Iowa, Decorah, IX.1882, Holway, E. W., N. Am. Fung. 1180, bark of ***Tilia americana***, as ***Hypoxylon atropurpureum*** by Ellis, J. B. (NY [3 pks.], HOLOTYPE of ***Hypoxylon cinereolilacinum***); Illinois, Riverside, 6.III.1909, Harper, E. T. & S. A. 2391, corticated wood of ***Tilia americana*** (S, HOLOTYPE of ***Nummularia anthracina*** *var.* ***tiliaecola***).

NOTES: Although the gross morphologies of ***B. cinereolilacina*** and ***B. repanda*** are quite different, each fungus has a germ slit on both sides of the ascospore and a reduced amount of carbonaceous tissue encasing the individual ostiole. Our collection data for ***B. cinereolilacina*** suggests a strong association with ***Tilia spp.***

Biscogniauxia citriformis (Whalley, Hammelev, & Taligoola) Van der Gucht & Whalley, Mycol. Res. 96: 895. 1992. Figs. 38 & 63
≡ ***Hypoxylon citriforme*** Whalley, Hammelev, & Taligoola, Trans. Brit. Mycol. Soc. 90: 141. 1988.

Illustrations: Whalley et al. (1988) [as ***Hypoxylon citriforme***].

Stromata applanate, 0.5–6 cm long x 0.5–5 cm broad x 0.7–1.2 mm thick; outer dehiscing layer dark brown, thin; mature surface gray; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid to tubular, 0.2–0.4 mm diam x 0.5–1 mm high. Ostioles lower than stromatal surface, with openings umbilicate, sometimes overlain with white substance. Asci 100–125 μm total length x 6–7 μm broad, the spore-bearing parts 70–90 μm long, the stipes 25–35 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1.5–2 μm high x 3.5 μm broad. Ascospores dark brown, unicellular, ellipsoid, strongly inequilateral, almost "C"-shaped in some orientations, with pinched ends, smooth, 10.5–12.5 x 5.5–7.5 μm, with straight, broad, faint germ slit spore-length on more convex side.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 2.5–3 wk, at first white, felty, azonate, with diffuse margins, becoming grayish, overlain with dull black, carbonized patches. Reverse uncolored. Sporulating regions scattered over entire surface of colony, whitish. Conidiogenous structure with ***Periconiella***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores brownish, coarsely roughened, composed of a main axis, 4–5 μm broad, and sometimes one or more major branches, branches terminating with two to five conidiogenous cells arising in whorls from the main axis and/or from major branches or from additional subordinate branches; additional branches infrequently produced. Conidiogenous cells cylindrical, hyaline to yellowish, finely roughened, 8–16 x 3–5 μm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid, 5.5–7.5 x 1.5–2 μm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: FRENCH GUIANA: Säul, Monts La Fumee, II.1986, Samuels, G. J. 3488 & 3496, wood (JDR; NY). NIGERIA: Akure, Idanre Forest, VIII.1979, Taligoola, corticated wood (IMI 315971, HOLOTYPE of ***Hypoxylon citriforme***). TAIWAN: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M. 80091106 (CULTURED), decorticated wood (JDR). U.S.A.: Hawaiian Islands, Hawaii, McKenzie Park, 4.I.1996, Rogers, J. D., (CULTURED), wood of ***Casuarina equisetifolia*** (JDR); Hawaiian Islands, Hawaii, Bird Park, 28.II.1996, Hemmes, D., DEH-1039, wood of ***Pisonia sandwichensis*** (JDR).

NOTES: Ascospores of this fungus are strongly inequilateral. Strongly inequilateral ascospores are frequently found among taxa with appendaged ascospores but infrequently found among taxa with nonappendaged ascospores. When the centrum of this fungus is wet, the constituents stick to knives and needles and can be drawn out into a sticky mass. It is a highly distinctive taxon.

Biscogniauxia citriformis (Whalley, Hammelev, & Taligoola) Van der Gucht & Whalley *var.* ***macrospora*** Van der Gucht & Whalley, Mycol. Res. 96: 896. 1992.

Illustrations: Van der Gucht and Whalley (1992).

The teleomorph is much like that of the typical variety except for having larger ascospores, (12–) 13.5–17.5 x 6.5–9 μm, and a conspicuous, narrow germ slit on the more convex side.

Anamorph unknown.

SPECIMENS EXAMINED: FRENCH GUIANA: Paul Isnard, ca. 150 km S of St. Laurent du Moroni, Citron, Mt. Lucifer, III.1986, Samuels, G. J. & Searwar, P. 4141, corticated wood (JDR; NY); Piste de Saint-Elie, II–III.1986, Samuels, G. J. 4083, recently dead tree (JDR; NY). GABON: Libreville, 5.VI.1979, Gilles, G., G-51, corticated wood (JDR). PAPUA NEW GUINEA: Morobe Province, Lae, 9.XI.1989, Van der Gucht, K. & De Meester, L., dead wood (GENT 89-1688, HOLOTYPE of ***Biscogniauxia citriformis*** *var.* ***macrospora***).

Biscogniauxia communapertura Y.-M. Ju & J. D. Rogers, *sp. nov.*
Figs. 16–18, & 42

Etymology: Refers to the ostiolar openings, each of which serves a number of perithecia.

Stromata applanata, 0.4–1.5 cm longa x 0.2–0.4 cm lata x 0.8 mm crassa; stratum externum dehiscens fuscum tenue; superficies matura fusca; textura proxime sub superficie et inter perithecia carbonacea; textura sub peritheciis inconspicua. Perithecia obovoidea vel tubularia, 0.1–0.2 mm diam x 0.3–0.5 mm alta, multa in circula deposita et per canalem communem ostiolarem emittentibus. Ostiola late deposita grosse papillata. Asci non visi. Ascosporae dilutae brunneae vel brunneae, unicellulares, ellipsoideae fere equilaterales, apicibus latis vel angustatis, leves, 8–11.5 x 4.5–6 μm, rima germinativa recta magnopere abbreviata praeditae.

Stromata applanate, 0.4–1.5 cm long x 0.2–0.4 cm broad x 0.8 mm thick; outer dehiscing layer dark brown, thin; mature surface black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid to tubular, 0.1–0.2 mm diam x 0.3–0.5 mm high, with numerous individuals arranged in rosettes and discharging through a single ostiolar canal. Ostioles widely spaced, higher than stromatal surface, with openings coarsely papillate. Asci not observed. Ascospores light brown to brown, unicellular, ellipsoid, nearly equilateral, with broadly to narrowly rounded ends, smooth, 8–11.5 x 4.5–6 μm, with straight germ slit much less than spore-length.

Anamorph unknown.

SPECIMEN EXAMINED: BRAZIL: São Leopoldo, Rick, J., Fung. Austro.-Amer. 273, twigs, as ***Nummularia clypeus*** by Theissen, F. (GZU-Petrak 1431, HOLOTYPE of ***Biscogniauxia communapertura***).

NOTES: This fungus is characterized by scattered, widely spaced, coarsely papillate ostiolar openings, each of which serves a number of perithecia, and by ascospore germ slits that are much less than spore-length. The part of exiccatum *Fungi Austro-Americani* no. 273 at BPI is immature.

Biscogniauxia dennisii (Pouzar) Pouzar, Česká Mykol. 33: 216. 1979.Fig. 15
≡ ***Nummularia dennisii*** Pouzar, Kew Bull. 31: 653. 1977.

Illustrations: Candoussau (1986).

Stromata raised-discoid, slightly concave, 0.4–2.7 cm long x 0.4–0.9 cm broad x 2–3.2 mm thick, with dark brown, distinct raised margins originating from outer dehiscing layer; mature surface blackish; carbonaceous immediately beneath surface; dark brown, woody between perithecia, with carbonaceous stromatal layer discretely enclosing each perithecium; tissue beneath perithecia composed largely of whitened host tissue, 0.5–1.5 mm thick; tissue of margins and bottoms 0.2–0.3 mm thick, dark brown, woody, with embedded carbonaceous fragments. Perithecia tubular, 0.3–0.5 mm diam x 1–1.8 mm high. Ostioles higher than stromatal surface, with openings coarsely papillate. Asci 150–170 μm total length x 12–14 μm broad, the spore-bearing parts 125–150 μm long, the stipes 20–30 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1–2 μm high x 6–7.5 μm broad. Ascospores dark brown to blackish brown, unicellular, ellipsoid, nearly equilateral, with narrowly to broadly rounded ends, smooth, 15.5–21 x 10.5–13.5 μm, with straight germ slit spore-length.

Cultures and anamorph have been described and illustrated by Callan and Rogers (1986) on potato dextrose agar with 5g/L yeast extract. The conidiogenous structure is ***Periconiella***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: SLOVAKIA: Zeliezovce, 19.X.1972, Pouzar, Z., corticated wood of ***Acer campestre***, as ***Nummularia elongata*** Pouzar, *ined.* (PR 773351, HOLOTYPE; K, ISOTYPE of ***Nummularia dennisii***). FRANCE: Landes, 1986, Candoussau, F., wood of ?***Quercus pedunculata*** (JDR).

NOTES: Perithecia of ***B. dennisii*** are discretely enclosed by a thin layer of carbonaceous stromatal tissue. This type of carbonaceous layer is ubiquitous in ***Hypoxylon*** section ***Annulata*** (Ju and Rogers, 1996). This fungus was recently redescribed and illustrated by Candoussau (1986).

Biscogniauxia divergens (Theiss.) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990. Fig. 43
≡ ***Nummularia divergens*** Theiss., Ann. Mycol. 6: 349. 1908.
≡ ***Hypoxylon divergens*** (Theiss.) J. H. Miller *ex* Dennis, Kew Bull. 14: 450. 1960.
≡ ***Numulariola divergens*** (Theiss.) P. Martin, J. S. African Bot. 35: 289. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.

Illustrations: Miller (1961, Figs. 185 & 218) [as ***Hypoxylon divergens***].

Stromata applanate, 0.3–3 mm diam x 0.6 mm thick; outer dehiscing layer dark brown, thin; mature surface blackish with brownish shade; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.3–0.5 mm diam x 0.5–0.6 mm high. Ostioles at the same level as or lower than stromatal surface, with openings punctate. Asci not observed. Ascospores dark brown, ellipsoid, nearly equilateral, with one end narrowly rounded and the other bearing a hyaline cellular appendage 2–3 μm long x 2.5-3 μm broad, smooth, 15–22 (not including appendage) x 6–8 μm, with straight germ slit less than spore-length.

Anamorph unknown.

SPECIMENS EXAMINED: BRAZIL: Rick, J., wood (BPI 715224 [Lloyd herb. 10528], LECTOTYPE [selected by Miller (1961)] of ***Nummularia divergens***); São Leopoldo, 1912, Rick, J., *ex* Herb. J. R. Weir, wood, as ***Nummularia divergens*** (BPI [Lloyd herb. 20732]); São Leopoldo, 1912, Rick, J., wood, as ***Nummularia divergens*** (GZU-Petrak 1445).

NOTES: Miller (1961) selected Lloyd's specimen no. 10528 as the type which is accordingly accepted as the lectotype. Miller (1961) gave the ascospore size range as 17–24 (not including appendage) x 6–8 μm.

Miller (1961) erected *var.* ***macrospora*** for ***B. divergens*** which we consider synonymous with ***B. philippinensis***. We do not consider ***B. philippinensis*** to be a large-spored variety of ***B. divergens*** because the former differs in having strongly inequilateral ascospores and in having a spore-length ascospore germ slit that is broad and faint. ***Biscogniauxia philippinensis*** *var.* ***microspora*** and ***B. divergens*** differ in the former having broader ascospores that are strongly inequilateral with a broad, faint, spore-length germ slit.

Biscogniauxia doidgeae (J. H. Miller) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990.

≡ ***Hypoxylon doidgeae*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 110. 1961; as "***doidgei***."

≡ ***Numulariola doidgeae*** (J. H. Miller) P. Martin, J. S. African Bot. 35: 289. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.

Illustration: Miller (1961, Fig. 214) [as ***Hypoxylon doidgei***].

No specimens were examined. Miller (1961) gave the ascospore size range as 10–14 (not including appendage) x 5–6 μm.

Anamorph unknown.

NOTES: We were unable to locate the type material at PREM.

Biscogniauxia fuscella (Rehm) San Martín & J. D. Rogers, Mycotaxon 47: 233. 1993. Figs. 3 & 44

≡ ***Nummularia fuscella*** Rehm, Ann. Mycol. 2: 176. 1904.

≡ ***Hypoxylon fuscellum*** (Rehm) J. H. Miller, Mycologia 25: 325. 1933.

≡ ***Numulariola fuscella*** (Rehm) P. Martin, J. S. African Bot. 35: 292. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

= ? ***Diatrype exutans*** Cooke, J. Linn. Soc., Bot. 17: 143. 1878.

≡ ***Hypoxylon exutans*** (Cooke) Cooke, Grevillea 8: 66. 1879.

≡ ***Anthostoma exutans*** (Cooke) Sacc., Syll. Fung. I, p. 296. 1882.

≡ ***Nummularia exutans*** (Cooke) Cooke, Grevillea 12: 8. 1883.

≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***exutans*** (Cooke) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 124. 1961.

≡ ***Numulariola exutans*** (Cooke) P. Martin, J. S. African Bot. 35: 304. 1969.

≡ ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze *var.* ***exutans*** (Cooke) Van der Gucht, Mycotaxon 45: 266. 1992.

≡ ***Biscogniauxia exutans*** (Cooke) Barr, Mycotaxon 46: 392. 1993.

Stromata applanate, fragmentary, up to 3 cm long x 1 mm thick; outer dehiscing layer white or buff-colored, thin; mature surface pale mouse gray, becoming grayish sepia and eventually fuscous; carbonaceous immediately beneath surface; gray to grayish brown, woody between perithecia, with carbonaceous stromatal layer discretely enclosing each perithecium; tissue beneath perithecia enclosed in black, sac-like fungal tissue that is continued from margins of stromata, composed largely of host tissue, ca. 0.5 mm thick. Perithecia obovoid to tubular, 0.3–0.4 mm diam x 0.5 mm high, sometimes with several sharing a common ostiolar canal. Ostioles higher than stromatal surface, with openings slightly papillate to papillate. Asci 105–125 μm total length x 8.5–10 μm broad, the spore-bearing parts 95–110 μm long, the stipes 10–18 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1–1.5 μm high x 3.5–4.5 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid, short fusoid, or pyriform, nearly equilateral, with narrowly rounded ends sometimes pinched, smooth, 13–16.5 x 6.5–8 μm, with straight germ slit spore-length, with a cellular appendage on immature ascospores and some mature ascospores.

Cultures and anamorph have been described by San Martín and Rogers (1993) on 2% Difco oatmeal agar. The conidiogenous structure is ***Periconiella***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: MEXICO: Tamaulipas State, Victoria Municipality, Km 2 Victoria City-Matamoros City Rd., 5.IX.1988, San Martín, F. 1011, wood of ***Celtis laevigata***, as ***Biscogniauxia fuscella*** (ITCV; JDR). U.S.A.: Texas, Long, W. A. 481, ***Celtis*** (S, HOLOTYPE; BPI 11202; GAM 2474 & 2475; GZU-Petrak 2124, ISOTYPES of ***Nummularia fuscella***); Texas, Galveston Bay, Ravenel, H. W. 76, wood (K 36394, HOLOTYPE of ***Diatrype exutans***); Texas, San Antonio, 30.VI.1926, Nuttall, L. W., wood of ***Celtis missisippiensis***, as ***Nummularia exutans*** (GZU-Petrak 1446).

NOTES: This fungus has a white to buff-colored outer dehiscing layer. The stromatal surface is pale mouse gray when young, becoming darker afterwards. It is noteworthy that ***B. fuscella*** shows a cellular appendage on some mature ascospores. The cellular appendage is readily observed on immature ascospores. While ascospores are maturing, the appendage usually disintegrates and thus only persists on some mature ascospores. Vertical sections of stromata reveal that ***B. fuscella*** has the hypothetical stromatal anatomy diagrammed in Fig. 5C of Ju and Rogers (1996). Miller

(1961) placed this fungus in ***Hypoxylon*** section ***Papillata***, subsection ***Papillata***.

We suspect that ***B. exutans*** [≡ ***Diatrype exutans***] belongs here. The holotype material at the Cooke herbarium of K has a white outer dehiscing layer and frequently short fusoid to pyriform ascospores. Unfortunately, the material is somewhat depauperate; we did not find asci or ascospores with cellular appendages. Moreover, we were unable to determine the configuration of different types of stromatal tissue. Miller (1961) misinterpreted the type specimen of ***Diatrype exutans*** and treated it as a variety of "***Hypoxylon***" ***nummularium***. Thereafter, it has widely been applied to collections of ***B. capnodes*** with ascospore size ranges close to the upper limit.

Biscogniauxia grenadensis (J. H. Miller) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990. Fig. 45

≡ ***Hypoxylon grenadense*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 110. 1961.

≡ ***Numulariola grenadensis*** (J. H. Miller) P. Martin, J. S. African Bot. 35: 289. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

= ***Hypoxylon grenadense*** J. H. Miller *var.* ***macrospora*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 111. 1961.

≡ ***Numulariola grenadensis*** (J. H. Miller) P. Martin *var.* ***macrospora*** (J. H. Miller) P. Martin, J. S. African Bot. 35: 289. 1969; [*nom. inval.*, ICBN Art. 33.2].

≡ ***Biscogniauxia grenadensis*** (J. H. Miller) Whalley & Laessøe *var.* ***macrospora*** (J. H. Miller) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990.

Stromata applanate, up to 8 cm long x 1–4 cm broad x 0.6–0.8 mm thick; outer dehiscing layer dark brown, thin; mature surface dark brown; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.2–0.4 mm diam x 0.5–0.6 mm high. Ostioles at the same level as or lower than stromatal surface, with openings punctate, usually surrounded by slightly raised rim. Asci fragmentary, with apical ring bluing in Melzer's iodine reagent, discoid, 2–2.5 μm high x 3.5–4 μm broad. Ascospores brown to dark brown, ellipsoid-inequilateral, with one end narrowly rounded and frequently pinched, and the other bearing a hyaline cellular appendage 2–3 μm long x 2-3 μm broad, smooth, 12–16 (not including appendage) x (5–) 5.5–7.5 μm, with straight germ slit spore-length on more convex side.

Cultures and anamorph have been described and illustrated by Rogers (1966) and Jong and Rogers (1972) on potato dextrose agar with 5g/L yeast extract. [both as ***Hypoxylon grenadense*** *var.* ***macrospora***]. The conidiogenous structure is approximately ***Sporothrix***-like and tends to be ***Nodulisporium***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: JAMAICA: 28.X.1902, Earle, F. S. 236, corticated wood (GAM 12809, ISOTYPE of ***Hypoxylon grenadense*** *var.* ***macrospora***). GRENADA: Grand Etang, 1912–13, Thaxter, R. 6886, blackened corticated wood, as ***Hypoxylon anthracodes*** (FH, HOLOTYPE; GAM 2005, ISOTYPE of ***Hypoxylon grenadense***); Grand Etang, 1912–13, Thaxter, R. 6877 & 6901, blackened corticated wood, as ***Hypoxylon anthracodes*** (FH, PARATYPES; GAM 2004 & 2006, ISOPARATYPES of ***Hypoxylon grenadense***).

NOTES: ***Biscogniauxia grenadensis*** differs from ***B. uniapiculata*** in having dark brown rather than black mature stromatal surface and in frequently having a pinched end on the ascospore. Examination of various specimens led us to conclude that only a single variety—*var.* ***grenadensis*** need be recognized. Rogers (1966, 1967) has discussed the cytology of the ascospore and the anamorph.

Van der Gucht (1995) reported ***B. grenadensis*** *var.* ***macrospora*** from Papua New Guinea. Her collections [Madang Province, Ramu region, Paiya, 26.V.1992, Vyverman, W. & R., dead wood (GENT 92-1381); same collecting data, Van der Gucht, K. & De Meester, L., dead wood (GENT 92-1368)] look like ***B. grenadensis*** except for having a black mature stromatal surface and having the ascospore germ slit on the less convex side. These collections may represent a distinct taxon.

Biscogniauxia kalchbrenneri (Sacc.) Y.-M. Ju & J. D. Rogers, *comb. nov.*
Fig. 24

≡ ***Hypoxylon kalchbrenneri*** Sacc., Syll. Fung. I, p. 364. 1882.
≡ ***Nummularia kalchbrenneri*** (Sacc.) J. H. Miller, Bothalia 4: 260. 1942.
≡ ***Numulariola kalchbrenneri*** (Sacc.) P. Martin, J. S. African Bot. 35: 293. 1969.
≡ ***Hypoxylon placenta*** Kalchbr., Grevillea 9: 28. 1880; *non* (Link) Sacc., 1882; [*nom. rejic.*, Art. 13.1(d)].
≡ ***Nummularia placenta*** (Kalchbr.) Cooke, Grevillea 12: 8. 1883.
= ? ***Nummularia lepida*** Syd. & P. Syd., Ann. Mycol. 22: 425. 1924.
 ≡ ***Hypoxylon lepidum*** (Syd. & P. Syd.) Van der Bijl, Ann. Univ. Stell. 10: 7. 1932.

Stromata barely raised, orbicular, with indistinctly raised margins, 2.5–5 mm diam x 0.7–1.3 mm thick; outer dehiscing layer not observed; mature surface blackish; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid to tubular, 0.3–0.6 mm diam x 0.8 mm high. Ostioles lower than stromatal surface, with openings punctate, sometimes overlain with white substance. Asci fragmentary, with apical ring bluing in Melzer's iodine reagent, discoid, 0.5 μm high x 2.5–3 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid, nearly equilateral, with narrowly rounded ends, smooth, (9.5–) 10–12 (–13) x 5–6 μm, with straight germ slit spore-length.

Cultures and anamorph have been described and illustrated by Martin (1969) on 2% malt agar. He illustrated a seemingly ***Periconiella***-like conidiogenous structure as defined by Ju and Rogers (1996) without a well-defined main axis.

SPECIMEN EXAMINED: SOUTH AFRICA: Somerset East, MacOwan 1304, wood (GAM 12826; K, TYPES of ***Hypoxylon placenta*** Kalchbr.).

NOTES: Unlike the other discoid ***Biscogniauxia*** species, ***Biscogniauxia kalchbrenneri*** does not have prominently raised stromata and raised stromatal margins.

According to Miller (1942) [under ***Nummularia kalchbrenneri***], ***Nummularia lepida*** Syd. & P. Syd. is a synonym. Unfortunately, we were unable to locate the type of ***N. lepida*** at S. Also see Ju and Rogers (1996) for comments on ***Hypoxylon placenta*** Kalchbr.

Biscogniauxia marginata (Fr.: Fr.) Pouzar, Česká Mykol. 33: 216. 1979. Fig. 46

≡ ***Sphaeria marginata*** Fr.: Fr., Elench. Fung. II, p. 69. 1828; *non* Sowerby, 1803; *nec* Schwein., 1832.

≡ ***Nummulariella marginata*** (Fr.: Fr.) Eckblad & Granmo, Norwegian J. Bot. 25: 72. 1978.

= ***Sphaeria discreta*** Schwein., Trans. Am. Phil. Soc. Philadelphia n. ser. 4: 195. 1832.

≡ ***Nummularia discreta*** (Schwein.) Tul. & C. Tul., Sel. Fung. Carp. II, p. 45. 1863.

≡ ***Diatrype discreta*** (Schwein.) M. A. Curtis, Geol. Nat. Hist. Surv. North Carolina, pt. III, p. 141. 1867.

≡ ***Hypoxylon discretum*** (Schwein.) Berk., Grevillea 4: 94. 1876.

≡ ***Biscogniauxia discreta*** (Schwein.) Kuntze, Rev. Gen. Plant. 2: 398. 1891.

≡ ***Numulariola discreta*** (Schwein.) House, New York State Mus. Bull. 266: 49. 1925.

= ***Sphaeria excavata*** Schwein., Trans. Am. Phil. Soc. Philadelphia n. ser. 4: 195. 1832.

≡ ***Nummularia excavata*** (Schwein.) Ellis & Everh., J. Mycol. 5: 20. 1889.

= ***Nummularia peziziformis*** C. G. Lloyd, Mycol. Writings 7: 1280. 1924.

Illustrations: Miller (1932) [as ***Nummularia discreta***]; Jong and Benjamin (1971) [as ***Nummularia discincola***]; Granmo et al. (1989).

Stromata raised-discoid, with concave surface, 3.5–7 mm diam x 2–3 mm thick, with dark brown to black, distinct raised margins originating from outer dehiscing layer; mature surface blackish; dark brown, woody immediately beneath surface and between perithecia, with carbonaceous tissue encasing each individual ostiole; tissue beneath perithecia composed largely of host tissue; tissue of margins 0.1–0.2 mm thick, carbonaceous, extending downwards into substrate. Perithecia obovoid, 0.3–0.5 mm diam x 0.5–1 mm high. Ostioles at the same level as or slightly lower than stromatal surface, with openings smooth to slightly punctate, usually overlain with white substance. Asci 170–200 μm total length x 12–14 μm broad, the spore-bearing parts 130–160 μm long, the stipes 25–40 μm long, with apical ring bluing or not bluing in Melzer's iodine reagent, discoid, 2.5–3 μm high x 5–5.5 μm broad. Ascospores brown to dark brown, unicellular, subglobose, equilateral, with broadly rounded ends, smooth, 13–16.5 x 9.5–13.5 μm, with sigmoid germ slit spore-length.

Cultures and anamorph have been described and illustrated by Callan and Rogers (1986) on potato dextrose agar with 5g/L yeast extract and by Petrini and Müller (1986) on 2% malt agar. The conidiogenous structure is ***Nodulisporium***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: CZECH REPUBLIC: Mähren-Weisskirchen, Podhorn, VIII. 1837, Petrak, F., Cryptog. Exs. Edit. Mus. Hist. Nat. Vindobonensi 4645, ***Sorbus aucuparia***, as ***Nummularia discreta*** (LE 127035). FRANCE: Bambouseraie, Uhart-Mixe, 21.IX.1986, Candoussau, F. 5352, corticated wood of ***Carpinus*** (JDR). HUNGARY: Budapest in monte Jarost, 22.III.1914, Noeltz?, ***Tilia platyphyllos*** [in fact on ***Sorbus***!], as ***Nummularia discreta*** (LE 127024). ITALY: Carestia, distributed as Esb. Critt. Ital. 473, wood (BPI, HOLOTYPE of ***Nummularia peziziformis***). NORWAY: Aust-Agder, Grimstad, 11.VII.1995, Granmo, A. 65/95, corticated wood of ***Sorbus aucuparia*** (TROM). RUSSIA: Smolensk oblast, Pietrovo prope Smolensk, VIII.1895, Tranzschel & Jacz.-Jaczewski, Komarov, Tranzschel's Fungi Rossiae Exs. 139, ***Sorbus aucuparia***, as ***Nummularia discreta*** (LE 127022, 127025, 127027, & 127034); Tomsk oblast: Kuznetskij uezd, 23.VI.1925, Vapdakorova, ***Sorbus aucuparia***, as ***Nummularia discreta*** (LE 127030); Marijskaja autonom republic, Joškar-Olinskij territory, at village Kuzj'javskaja, 4.VIII.1932. Vagilkov, ***Sorbus***. (LE 127037). TATARIJA REPUBLIC: Kasan (Helvetia [?] Rossica) [most prob. Kazan (lat. Kasanum)], no date, Kosjinsky & Dach, ***Sorbus aucuparia***, as ***Nummularia discreta*** (LE 127029 & 127033). U.S.A.: Illinois, Urbana, campus of Univ. of Illinois, VI.1983, Glawe, D. A., wood of ***Amelanchier*** (JDR); Iowa, Ames, VII.1983, Jensen, J. et al., wood, as ***Nummularia discincola*** (WSP); New York, 2.V.1944, Latham, R. 22965, wood of ***Malus***, as ***Nummularia discreta*** (GZU-Petrak 1416); New York, Alcove, I.1894, Shear, C. L., wood of ***Malus***, as ***Nummularia discreta*** (GZU-Petrak 1444); North Carolina, Salem & Pennsylvania, Bethlehem, Syn. 1249, wood (PH, HOLOTYPE of ***Sphaeria discreta***); Pennsylvania, Bethlehem, Schweinitz, L. V. D., wood, as ***Sphaeria discincola*** (UPS, LECTOTYPE [selected by Eckblad and Granmo (1978)] of ***Sphaeria marginata***); Pennsylvania, Bethlehem, Syn. 1250, wood (PH, HOLOTYPE of ***Sphaeria excavata***); Pennsylvania, Bethlehem, Syn. 1250, Collins coll. no. 8, wood (PH, ISOTYPE of ***Sphaeria excavata***); Schweinitz, L. V. D., wood (UPS, TYPE of ***Sphaeria excavata***).

NOTES: ***Biscogniauxia marginata*** is unique among the ***Biscogniauxia*** taxa in having subglobose ascospores with a sigmoid germ slit. Gross morphologies of ***B. marginata*** and ***B. baileyi*** are similar. The latter, however, has a straight germ slit on the ascospore. The conidiogenous structure described by Callan and Rogers (1986) and Petrini and Müller (1986) is ***Nodulisporium***-like. However, that described by Whalley and Edwards (1985) is ***Geniculosporium***-like. This fungus was long known as ***Nummularia discreta***, the cause of nail-head or blister disease of ***Malus***. It is commonly associated with the Rosaceae.

Biscogniauxia mediterranea (De Not.) Kuntze, Rev. Gen. Plant. 2: 398. 1891. Figs. 9–11

≡ ***Sphaeria mediterranea*** De Not., Mem. Accad. Torino 13: 96. 1853.

≡ ***Nummularia mediterranea*** (De Not.) Sacc., Syll. Fung. I, p. 400. 1882.
≡ ***Hypoxylon mediterraneum*** (De Not.) J. H. Miller, Mycologia 33: 75. 1941.
≡ ***Numulariola mediterranea*** (De Not.) P. Martin, J. S. African Bot. 35: 312. 1969.
≡ ***Nummularia regia*** (De Not.) Sacc. *var.* ***mediterranea*** (De Not.) Traverso, Fl. Ital. Crypt. I, p. 59. 1906.
= ***Sphaeria clypeus*** Schwein., Schrift. Naturf.-Ges. Leipzig I, p. 31. 1822.
  ≡ ***Hypoxylon clypeus*** (Schwein.) M. A. Curtis, Geol. & Nat. Hist. Survey, N.C. III, p. 140. 1867.
  ≡ ***Diatrype clypeus*** (Schwein.) Berk., Grevillea 4: 95. 1876.
  ≡ ***Nummularia clypeus*** (Schwein.) Cooke, Grevillea 12: 6. 1883.
= ***Hypoxylon regium*** De Not., Sfer. Ital. Cent. I, fasc. I, n. 12, p. 15. 1863.
  ≡ ***Nummularia regia*** (De Not.) Sacc., Syll. Fung. I, p. 400. 1882.
= ***Sphaeria sertata*** Durieu & Mont., *apud* Durieu, Fl. Alger. I, p. 455. 1869.
  ≡ ***Hypoxylon sertatum*** (Durieu & Mont.) Mont., Syll. Crypt., p. 214. 1856.
  ≡ ***Nummularia sertata*** (Durieu & Mont.) Cooke, Grevillea 11: 126. 1883.
= ***Hypoxylon repandoides*** Fuckel, Symb. Myc. Jahrb. Nassau Ver Natur. 23: 236. 1869.
  ≡ ***Nummularia repandoides*** (Fuckel) Sacc., Syll. Fung. I, p. 400. 1882.
= ? ***Hypoxylon stigmateum*** Cooke, Grevillea 7: 4. 1878.

Illustrations: Miller (1961, Figs. 188 & 222) [as ***Hypoxylon mediterraneum***].

Stromata applanate, 1.8–7 cm long x 0.5–4 cm broad x 0.6–1 mm thick; outer dehiscing layer dark brown, 0.4–0.8 mm thick; mature surface blackish to shiny black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid to tubular, laterally flattened, 0.1–0.2 mm diam x 0.5–0.8 mm high, usually with several packed inside the same stromatal locule, 0.3–0.4 mm diam, and sharing a common ostiolar canal. Ostioles higher than stromatal surface, with openings coarsely papillate. Asci 160–185 μm total length x 9–12.5 μm broad, the spore-bearing parts 120–150 μm long, the stipes 20–35 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 2–3 μm high x 4–5 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid, nearly equilateral, with narrowly to broadly rounded ends, smooth, 15.5–21 x (6.5–) 7–10 μm, with straight germ slit spore-length.

Cultures and anamorph have been described and illustrated by Jong and Rogers (1972) [as ***Hypoxylon mediterraneum*** *var.* ***mediterraneum***] on potato dextrose agar with 5g/L yeast extract and by Petrini and Müller (1986) on 2% malt agar. The conidiogenous structure is ***Periconiella***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: AUSTRIA: Wien, Mitter-Wolfsgraben bei Kresbrunn im Wiener Wald, VI.1898, v. Höhnel, Rehm's Ascom. Exs. 1389, ***Fagus sylvatica***, as ***Nummularia repandoides*** (LE 127109). BRAZIL: S. Fiel, 17.VI.1957, Torrend, C. 7808, wood of ***Eucalyptus***, as ***Nummularia succentralia*** Torrend, *ined.* (WSP 48725). FRANCE: Forêt de Lespinasse, 15.X.1986, Candoussau, F. 5333-C, wood of ***Fagus*** (JDR); Oloron, Forêt de

Bugangue, 23.IV.1995, Candoussau, F. 366, corticated wood of ***Fagus*** (JDR). GEORGIA: vic. of Kutaisi, II.1935, Beljaev, cork oak, ***Nummularia repandoides*** (LE 127108). GERMANY: Nassau, Fuckel, L., Herb. Barbey-Boissier, 350, Fungi Rhenani 2266, wood of ***Fagus*** (WSP 22116, TYPE of ***Nummularia repandoides***); Nassau, Oestrich, Fuckel, L., Herb. Barbey-Boissier 351, Fungi Rhenani 1062, wood of ***Fagus sylvatica***, as ***Nummularia bulliardi*** (WSP 22117); Hanover, Eilenrieda, X.1907, Engelke, Rehm's Ascom. Exs. 1769, wood of ***Fagus***, as ***Nummularia anthracina*** (GZU-Petrak 1437; LE 127012). ITALY: prope Iglesias, 1835, Sardinia, wood of ***Quercus*** (RO [2 pks.], HOLOTYPE of ***Sphaeria mediterranea***); Valle Intrasca, 1859, wood of ***Juglans*** (RO, HOLOTYPE; BPI, ISOTYPE of ***Hypoxylon regium***). MAURITANIA: La Calle, 1834 & 1840, Durieu, M., wood (PC [3 pks.], SYNTYPES of ***Sphaeria sertata***); *ex* Paris herb., wood (BPI, ISOSYNTYPE of ***Sphaeria sertata***). MEXICO: Tamaulipas State, Gómez Farías Town, 14.IX.1988, San Martín, F. 1130, wood, as ***Biscogniauxia mediterranea*** (ITCV; JDR). NIGERIA: no date, leg. illegible, wood, as ***Nummularia mediterranea*** (GZU-Petrak 2132). PORTUGAL: 1969, no. 196, wood of ***Quercus suber*** (JDR). RUSSIA: Caucasus borealis, Adygeja aut. rep., Majkop, 24.VII.1911, Sjestop, N., as ***Nummularia bulliardi*** (LE 127013); either Stavropol territory or Kalmykija aut. rep., Terskaja guvernement, Prikumskij uezd, vic. of Village Vladimirovka, 3.XI.1923, stump of ***Quercus***, as ***Nummularia repandoides*** (LE127104 & 127105). UKRAINE: Nikolajev oblast, Vladimirovskaja, VIII.1948, Kleošnik, ***Quercus***, as ***Nummularia repandoides*** (LE 127107). U.S.A.: Alabama, Tuskegee, 3.I.1936, Carver, G. W., wood of ***Celtis***, as ***Nummularia clypeus*** (GZU-Petrak 1436); California, 2.II.1924, Parks, H. E., wood of ***Lithocarpus***, as ***Nummularia clypeus*** (GZU-Petrak 1417); California, Marin Co., Muir Woods, 2.II.1924, Parks, H. E., wood of ***Pisonia***, as ***Nummularia clypeus*** by Shear, C. L. (GZU-Petrak 1438); Indiana, Scottsburg, VI.1913, Weir, J. R., wood of ***Fagus***, as ***Nummularia clypeus*** by Shear, C. L. (GZU-Petrak 1480); Indiana, Hendricks Co., 10.I.1911, Fuson, S. C., wood, as ***Nummularia clypeus*** by Shear, C. L. (GZU-Petrak 1433); New Jersey, Newfield, V.1893, Ellis, J. B., Fungi Columbiani 41, dead oak saplings, as ***Nummularia bulliardi*** (WSP 4782); New York, Ithaca, Six Mile Creek, 25.IV.1903, Thom, C., wood, as ***Nummularia clypeus*** (GZU-Petrak 1432); North Carolina, Salem & Pennsylvania, Bethlehem, wood, relabeled as ***Sphaeria nummularia*** by Schweinitz, L. D. V. (PH, HOLOTYPE of ***Sphaeria clypeus***); North Dakota, Anselm, Sand Hills, 28.VIII.1920, Brenckle, J. F., Fungi Dakotenses 481, wood of ***Quercus macrocarpa***, as ***Nummularia bulliardi*** (WSP 23394); Ohio, Butler Co., 1974, Goree, H. K. 3374, wood of ***Fagus grandifolia*** (JDR); Oregon, Grant's Pass, IX.1916, Weir, J. R. 2739, wood of ***Quercus californica***, as ***Nummularia clypeus*** (GZU-Petrak 1440); Virginia, Falls Church, 10.II.1946, Fosbery, F. R., wood of ***Acer rubrum***, as ***Nummularia clypeus*** (GZU-Petrak 1435); Wisconsin, Oshkosh, 23.XII.1903, Shontz, H. L., bark of ***Acer***, as ***Nummularia clypeus*** (GZU-Petrak 1434); leg. Long, *ex* Lloyd herb., wood, as ***Nummularia stigmatea*** by Cooke, M. C. (GZU-Petrak 2141). LOCALITY UNKNOWN: wood (L 910, 267-853, TYPE of ***Sphaeria***

incrustans); *ex* Lloyd herb., wood, as ***Nummularia sertata*** (GZU-Petrak 2140); Rehm's Ascom. Exs. 1389, wood, as ***Nummularia repandoides*** (GZU-Petrak 1485).

NOTES: The outer dehiscing layer of ***B. mediterranea*** is thick, as is that of its large-spored variety, ***macrospora***. However, the outer dehiscing layer of ***B. mediterranea*** var. ***microspora*** is thin, ca. 0.1 mm thick.

The conidiogenous structure is typically ***Periconiella***-like (Jong and Rogers, 1972). Martin (1969), however, stated that "This species shows enormous variation in size, shape and construction of the conidiophores, ranging all the way from a simple ***Sporothrix*** type through ***Acrostaphylus*** to the extremely complex ***Basidiobotrys***." We have not seen a ***Xylocladium*** [= ***Basidiobotrys***] state for any ***Biscogniauxia***.

The basionym of ***B. mediterranea***, ***Sphaeria mediterranea*** De Not., is predated by ***S. clypeus*** Schwein. ***Sphaeria clypeus*** was considered by Fries (1823) to be a synonym of ***S. nummularia*** (Bull.: Fr.) DC. & Lam. This apparently led Schweinitz (1832) to relabel his ***S. clypeus*** specimens as ***S. nummularia***. Miller (1961) considered ***S. clypeus*** to be a *nomen confusum* and cited it as a possible synonym for both ***Hypoxylon mediterraneum*** (De Not.) Ces. & De Not. [≡ ***Biscogniauxia mediterranea*** (De Not.) Kuntze] and ***H. tinctor*** (Berk.) Cooke [≡ ***Camillea tinctor*** (Berk.) Laessøe, J. D. Rogers, & Whalley]. Prior to Miller (1961), ***Nummularia clypeus*** (Schwein.) Cooke had been widely used for this fungus in North America (e.g., Cooke, 1883; Ellis and Everhart, 1892; Shear, 1941). We examined several specimens that were relabeled as ***Sphaeria nummularia*** by Schweinitz from PH. The packet containing material collected from Salem and Bethlehem is considered to be Schweinitz's original material from North Carolina, and is accordingly accepted as the holotype of ***S. clypeus***. Other specimens are later collections from Pennsylvania; they are either ***C. tinctor*** or ***C. punctulata*** (Berk. & Ravenel) Laessøe, J. D. Rogers, & Whalley. Some of the ***C. punctulata*** specimens are immature. A specimen labeled as ***Sphaeria nummularia var. striata***, an unpublished variety from New York, is ***C. tinctor***. Two packets [as ***Sphaeria nummularia*** (BPI 800382 & 800383)] that were split from the Schweinitz material by C. L. Shear do not have ascospores. However, the punctate ostioles suggest ***C. punctulata*** rather than ***B. mediterranea***. They apparently correspond to the Schweinitz collections from Pennsylvania. Owing to a certain amount of confusion, however, and the fact that ***B. mediterranea*** is so widely known, we continue to accept this name. ***Sphaeria sertata*** Durieu & Mont. was originally published by Durieu and Montagne in the first volume of Durieu's *Flore d'Algérie*. The publishing date of this work was considered to be from 1846 to 1849 by Lindau and Sydow (1908), earlier than the publishing date of ***S. mediterranea***. However, Dennis (1984) noted that the publication of *Flore d'Algérie* was delayed until 1869, even after Montagne (1856) had made the combination ***Hypoxylon sertatum*** (Durieu & Mont.) Mont. One of the type specimens of ***S. incrustans*** Pers.: Fr. [≡ ***Hypoxylon incrustans*** (Pers.: Fr.) Mont.] at L is this fungus. ***Sphaeria incrustans*** was considered to be a *nomen confusum* by Ju and Rogers (1996). We were unable to locate the type of ***Hypoxylon stigmateum*** Cooke at K. A specimen identified by Cooke as ***Nummularia stigmatea*** at GZU is ***B. mediterranea***.

Biscogniauxia mediterranea (De Not.) Kuntze *var.* ***macrospora*** (J. H. Miller) Y.-M. Ju & J. D. Rogers, *comb. nov.*
≡ ***Hypoxylon mediterraneum*** (De Not.) Ces. & De Not. *var.* ***macrospora*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 118. 1961.

The teleomorph is much like that of the typical variety except for having larger ascospores, 20–26 x 11.5–13 μm.

Anamorph unknown.

SPECIMEN EXAMINED: VENEZUELA: Fendler, wood, as ***Hypoxylon clypeus*** Schwein. (NY, HOLOTYPE of ***Hypoxylon mediterraneum*** *var.* ***macrospora***).

NOTES: A New Zealand collection [Wellington, 17.IX.1917, Cunningham, Y. H., wood, as ***Nummularia regia*** (GZU-Petrak 2139)] is much like this fungus except for having narrower ascospores, 22–25 x 9–11 μm, and more or less inequilateral ascospores with less than spore-length to spore-length germ slit frequently on the less convex side.

Biscogniauxia mediterranea (De Not.) Kuntze *var.* ***microspora*** (J. H. Miller) Y.-M. Ju & J. D. Rogers, *comb. nov.*
≡ ***Hypoxylon mediterraneum*** (De Not.) Ces. & De Not. *var.* ***microspora*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 117. 1961.

The teleomorph is much like that of the typical variety except for having smaller ascospores 12–17 x 5.5–7.5 μm and having a thin outer dehiscing stromatal layer ca. 0.1 mm thick.

Cultures and anamorph have been described and illustrated by Jong and Rogers (1972) [as ***Hypoxylon mediterraneum*** *var.* ***microspora***] on potato dextrose agar with 5g/L yeast extract. The conidiogenous structure is ***Periconiella***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: CANADA: British Columbia, Vancouver Island, Shawnigan Lake, 29.VI.1955, Horner, R. & Engelhardt, N., decorticated wood of ***Alnus rubra***, as ***Hypoxylon mediterraneum*** *var.* ***microspora*** (GAM 12776, 12783, 12811, & 12868); British Columbia, Vancouver Island, Sooke Rd., 1.VII.1955, Horner, R. & Engelhardt, N., decorticated wood of ***Alnus rubra***, as ***Hypoxylon mediterraneum*** *var.* ***microspora*** (GAM 12782); British Columbia, Vancouver Island, Metchosin, 15.IV.1995, Callan, B., DAVFP 25112, wood of ***Alnus rubra*** (JDR). MEXICO: Tamaulipas State, Gómez Farías Municipality, San José, 15.IX.1993, San Martín, F. 1473T, wood (ITCV). U.S.A.: California, Berkeley, Strawberry Creek, 17.V.1925, Parks, H. E. 2727, wood of ***Alnus rubra***, as ***Nummularia bulliardi*** Tul. & Tul. (BPI 590270, HOLOTYPE of ***Hypoxylon mediterraneum*** *var.* ***microspora***); California, Humboldt Co., Trinidad, III.1936, Parks, H. E., wood of ***Alnus rubra***, as ***Nummularia bulliardi*** (GZU-Petrak 1428); California, Humboldt Co., Trinidad, Spruce Cove, IV.1935, Parks, H. E. 5400, wood of ***Ribes sanguineum***, as ***Nummularia bulliardi*** (W 1048); California, Humboldt Co., Trinidad, Spruce Cove, III.1952, Parks, H. E. 7544, wood of ***Holodiscus***

discolor, as ***Nummularia bulliardi*** (W 560); California, Humboldt Co., Trinidad, Spruce Cove, II.1939, Parks, H. E. 6222, wood of ***Ceanothus thyrsiflorus***, as ***Nummularia bulliardi*** (W 1236); California, Del Warle Co., Highway 101, Bigtree, 7.X.1985, Petrini, L. & O., wood of ***Alnus rubra*** (JDR); California, Trinidad, Spruce Cove, III.1934, Parks, H. E. 4763, wood of ***Rubus spectabilis***, as ***Nummularia rumpens*** (GZU-Petrak 1489); Washington, near Oyster Creek, south of Bellingham, 4.VIII.1979, Glawe, D. A. 79-244, wood (JDR).

Biscogniauxia mucigera Van der Gucht, Mycol. Res. 100: 702. 1996.
Fig. 47

Illustrations: Van der Gucht (1996).

Stromata applanate, fragmentary, up to 2 cm long x 0.3 mm thick; outer dehiscing layer dark brown, thin; mature surface black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia tubular, 0.05–0.1 mm diam x 0.2 mm high. Ostioles lower than stromatal surface, with openings punctate, usually with slightly raised rim. Asci 95–120 μm total length x 5–7 μm broad, the spore-bearing parts 85–110 μm long, the stipes 8–15 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 2 μm high x 3.5 μm broad. Ascospores brown, unicellular, ellipsoid, slightly inequilateral to equilateral, with broadly to, less frequently, narrowly rounded ends, smooth, 8.5–10.5 x 5–5.5 μm, with straight germ slit spore-length, with hyaline sheath.

Cultures and anamorph have been described and illustrated by Van der Gucht (1996) on 4% Difco malt extract agar. The conidiogenous structure is in general ***Nodulisporium***-like as defined by Ju and Rogers (1996).

SPECIMEN EXAMINED: PAPUA NEW GUINEA: Madang Province, Ramu region, 26.V.1992, Van der Gucht, K. & De Meester, L., dead wood (GENT 92-1270, HOLOTYPE of ***Biscogniauxia mucigera***).

NOTES: This fungus is the only species in ***Biscogniauxia*** shown to have a hyaline sheath surrounding the ascospore. It is known only from type material.

Biscogniauxia nothofagi Whalley, Laessøe, & Kile, Mycol. Res. 94: 237. 1990.

Illustrations: Whalley et al. (1990a).

Ascospores have a hyaline cellular appendage. No specimens were examined. Whalley et al. (1990a) gave the ascospore size range as (12.2–) 13.2–14.6 (–15.0) x 7.1–8.0 μm. This fungus is similar to ***B. pithodes*** and ***B. mediterranea*** and its varieties in having coarsely papillate ostioles.

Cultures and anamorph have been described and illustrated by Whalley et al. (1990a).

Biscogniauxia nummularia (Bull.: Fr.) Kuntze, Rev. Gen. Plant. 2: 398. 1891.
Figs. 1 & 48

≡ ***Hypoxylon nummularium*** Bull.: Fr., Hist. Champ. Fr. I, p. 179. 1791.

≡ ***Sphaeria nummularia*** (Bull.) DC. & Lam., Fl. Franç. II, p. 290. 1805; (Bull.: Fr.) DC. & Lam., Syst. Mycol. II, p. 348. 1823.

≡ ***Nummularia nummularia*** (Bull.: Fr.) J. Schröt., Pilz. Schles. II, p. 458. 1897.
≡ ***Numulariola nummularia*** (Bull.: Fr.) House, New York State Museum Bull. 266: 49. 1925.
≡ ***Nummularia bulliardi*** Tul. & C. Tul., Sel. Fung. Carp. II, p. 43. 1863.
≡ ***Biscogniauxia bulliardi*** (Tul. & C. Tul.) Kuntze, Rev. Gen. Plant. 2: 398. 1891.
≡ ***Kommamyce bulliardi*** (Tul. & C. Tul.) Nieuwland, Amer. Midl. Naturalist 4: 375. 1916.
= ***Sphaeria anthracina*** Schmidt, Mycol. Heft., Leigzig 1: 55. 1817.
≡ ***Nummularia anthracina*** (Schmidt) Traverso, Fl. Ital. Crypt. Pyren. I, p. 57. 1906. *Fide* Fries (1823), Shear (1941), Miller (1961), and Pouzar (1986).
= ***Nummularia bulliardi*** Tul. & C. Tul. *var.* ***minor*** Rehm, Transzchel, & Serebrianikow, Mycotheca Rossica Sive Fungorum Rossiae Et Regionum Confinium Asiae Specimina Exsiccata, fasc. 6 & 7, no. 277. 1912.

Illustrations: Miller (1961, Figs. 193, 194, & 226) [as ***Hypoxylon nummularium***].

Stromata applanate, 0.5–6 cm long x 0.5–5 cm broad x 0.6–0.8 mm thick; outer dehiscing layer fawn-colored, thin; mature surface blackish; carbonaceous immediately beneath surface; tissue between perithecia woody, grayish brown, becoming dark brown; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.3–0.5 mm diam x 0.5–0.7 mm high. Ostioles slightly higher than stromatal surface with openings slightly papillate, or lower than stromatal surface with openings punctate and usually surrounded by slightly raised rim. Asci 95–120 μm total length x 9–10 μm broad, the spore-bearing parts 75–90 μm long, the stipes 15–30 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1.5–2.5 μm high x 3.5–4 μm broad. Ascospores dark brown, unicellular, ellipsoid, nearly equilateral, with broadly to, less frequently, narrowly rounded ends, smooth, 10–13 (–14) x (6.5–) 7.5–8.5 μm, with straight germ slit spore-length.

Cultures and anamorph have been described and illustrated by Greenhalgh and Chesters (1968) [as ***Hypoxylon nummularium***] on malt agar and by Petrini and Müller (1986) on 2% malt agar. The conidiogenous structure is ***Periconiella***-like as defined by Ju and Rogers (1996).

SPECIMENS EXAMINED: GERMANY: Niederdonau, Seehof bei Lunz, V.1943, Petrak, F., Mycotheca Generalis 459, wood of ***Fagus silvatica***, as ***Nummularia bulliardi*** (WSP 18336); Oberbayern, Wessling, no date, Rehm, Rehm's Ascom. Exs. 1769b, ***Fagus***, as ***Nummularia anthracina f. juvenilis***, *ined.* (LE 127007); Nordrhein-Westfalen?, Östricher Wald, In sylva Hostrichiensi, ca. 1870, Fuckel's Fung. Rhen. 1062, as ***Nummularia bulliardi*** (LE 127015). RUSSIA: Krasnodar Terr., Klutschewaja, Prov. Kuban, Caucasi bor., VI.1911, Serebrianikow, J., in Tranzschel & Serebrianikow's Mycotheca Rossica no. 277, wood of ***Fagus orientalis*** (LE 126997 & 127010, TYPES of ***Nummularia bulliardi*** *var.* ***minor***); Krasnodar terr., M. Labinsk, Menal dacha, 15.VIII.1946, Sergejev, K., ***Fagus***?, as ***Nummularia buillardi*** (LE 127016); Krasnodar terr., Maucesta near Sotschi, 29.IX.1986, Torkelsen, A.-E. 172/86, ***Fagus***, as ***Biscogniauxia nummularia*** *var.* ***nummularia*** (O). UKRAINE: Zakarpat terr.(USSR:Zakarpatskaja oblast) Mucatschevo, 22.VIII.1966, Djenbnovjetski, ***Fagus sylvatica***, as ***Nummularia bulliardii*** (LE 127017). U.K.: England, Bucks, Bix Valley, 4.X.1975, Whalley, A. J. S., corticated wood of ***Fagus*** (JDR); England, Surrey, Ranmore Common, VII.1979, Rogers, J. D. et al., corticated wood of ***Fagus*** (JDR [4 pks.]); England, Bucks, Princess Risborough, 4.X.1975, Whalley, A. J. S., corticated wood of ***Fagus*** (JDR); England, Oxford, Crowell Hill Wood, 5.X.1975, Whalley, A. J. S., corticated wood of ***Fagus*** (JDR). LOCALITY UNKNOWN: Mougeot, ***Fagus***, as ***Sphaeria nummularia*** DC. (L 910, 269-131); ***Fagus***, as ***Sphaeria nummularia*** DC., as ***Sphaeria anthracina*** Schmidt (L 910, 269-122); wood, as ***Sphaeria nummularia*** DC., as ***Hypoxylon nummularium*** Bull. (L 910, 269-134).

NOTES: ***Biscogniauxia nummularia*** is reported mainly from Europe and, indeed, is to be considered an European fungus. It is highly associated with ***Fagus***. Those varieties of ***Hypoxylon nummularium*** in Miller (1961), except for the typical variety and *var.* ***exutans***, are treated as either varieties of ***B. capnodes*** or their synonyms herein. Type material of ***H. nummularium*** *var.* ***exutans*** is possibly ***B. fuscella*** as discussed in NOTES on ***B. fuscella***. See also NOTES on ***B. capnodes*** for comparison of ***B. nummularia*** and ***B. capnodes***.

Biscogniauxia philippinensis (Ricker) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990. Fig. 49

≡ ***Nummularia philippinensis*** Ricker, Philipp. J. Sci. 1, suppl. 4: 280. 1906.

≡ ***Hypoxylon philippinense*** (Ricker) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 113. 1961.

≡ ***Numulariola philippinensis*** (Ricker) P. Martin, J. S. African Bot. 35: 289. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

= ***Hypoxylon divergens*** (Theiss.) J. H. Miller *var.* ***macrospora*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 112. 1961.

≡ ***Numulariola divergens*** (Theiss.) P. Martin *var.* ***macrospora*** (J. H. Miller) P. Martin, J. S. African Bot. 35: 289. 1969; [*nom. inval.*, ICBN Art. 33.2].

≡ ***Biscogniauxia divergens*** (Theiss.) Whalley & Laessøe *var.* ***macrospora*** (J. H. Miller) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990.

Illustration: Miller (1961, Fig. 218) [as ***Hypoxylon divergens*** *var.* ***macrospora***].

Stromata applanate, 5–10 cm long x 2–5 cm broad x 1.5–2.5 mm thick; outer dehiscing layer dark brown, thin; mature surface black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia tubular, 0.2–0.3 mm diam x 1.4–2.4 mm high. Ostioles at the same level as or lower than stromatal surface, with openings punctate, usually surrounded by slightly raised rim, sometimes overlain with white substance. Asci 190–220 μm total length x 13.5–14.5 μm broad, the spore-bearing parts 180–210 μm long, the stipes 10–15 μm long, with apical ring bluing in Melzer's iodine reagent, short-cylindrical, 6–7.5 μm high x 5.5–6 μm broad. Ascospores dark brown to blackish brown, ellipsoid-inequilateral, with one end narrowly rounded and the other bearing a hyaline cellular appendage 1.5–2 μm long x 4-5.5 μm broad, smooth, 22–27 (not including appendage) x 11.5–13 μm, with straight, broad, faint germ slit spore-length on more convex side.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 1.5 wk, at first white, felty, azonate, with diffuse and ropy margins, becoming greenish olivaceous (90) from center outwards. Reverse dull green (70), becoming olivaceous black (108). Sporulating regions scattered over entire surface of colony, whitish. Conidiogenous structure with ***Periconiella***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores brownish, coarsely roughened, composed of a main axis, 3–4 μm broad, and sometimes one or more major branches, the branches terminating with three to six conidiogenous cells arising in whorls from the main axis and/or from major branches or from additional subordinate branches; additional branches infrequently produced. Conidiogenous cells cylindrical, yellowish, finely roughened, 8–20 x 4.5–6 μm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid to short cylindrical, 6.5–9 x 3.5–4 μm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: GUYANA: Cuyuni-Mazaruni Region VII, Mazaruni Subregion VII-2, Imbaimadai, elev. 450 m, 15.II.1987, Samuels, G. J. et al. 4617, wood (JDR; NY). MEXICO: 1895, Smith, C. L. 203, wood, as ***Hypoxylon tinctor*** (NY, HOLOTYPE; GAM 12810, ISOTYPE of ***Hypoxylon divergens*** *var.* ***macrospora***); Chiapas State, Ocosingo Municipality, Montes Azules Biosphere Reserve, 21.VIII.1987, San Martín, F. 400 & 400B, wood, as ***Biscogniauxia divergens*** *var.* ***macrospora*** (ITCV; JDR). PHILIPPINES: Prov. Bataan, Luzon, X.1903, Merrill, E. D. 3537, prostrate log (BPI 595277, HOLOTYPE; BPI 595276 [Lloyd herb. 11300]; GZU-Petrak, ISOTYPES of ***Nummularia philippinensis***). TAIWAN: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M. 80082011 (CULTURED), log (JDR).

NOTES: Both ***B. philippinensis*** and ***B. pithodes*** have large, appendaged ascospores with a broad, faint germ slit. They differ in the latter having a white outer dehiscing stromatal layer and coarsely papillate ostioles.

Hypoxylon arecarium (Fr.: Fr.) Mont. [≡ ***Sphaeria arecaria*** Fr.: Fr.] may belong here. However, it was said to grow on trunks of a palm tree. See Ju and Rogers (1996) for comments on ***H. arecarium***.

Biscogniauxia philippinensis (Ricker) Whalley & Laessøe *var.* ***microspora*** Y.-M. Ju & J. D. Rogers, *var. nov.*

A varietate typica differt in ascosporis appendice cellulosa 2–3 μm longis x 3.5-4 μm latis, 13.5–19 (appendice exclusa) x 8–10 μm.

Differs from the typical variety in ascospores bearing a cellular appendage 2–3 μm long x 3.5-4 μm broad, 13.5–19 (not including appendage) x 8–10 μm.

Anamorph unknown.

SPECIMENS EXAMINED: GUYANA: Kopinang Mt., 750–790 m elev., 22.VII.1989, Samuels, G. J. et al. 6674, wood (NY, HOLOTYPE; WSP, ISOTYPE of ***Biscogniauxia philippinensis var. microspora***). INDONESIA: North Sulawesi, Dumoga-Bone National Park, vic. 'Camp 1440', elev. 211 m, 3–5.X.1985, Samuels, G. J. 2099A, bark, as ***Hypoxylon uniapiculatum var. macrosporum*** by Rogers et al. (1987) (JDR).

Biscogniauxia pithodes (Berk. & Broome) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990. Figs. 7 & 8

≡ ***Diatrype pithodes*** Berk. & Broome, Berk. & Broome, J. Linn. Soc., Bot. 14: 124. 1873.

≡ ***Anthostoma pithodes*** (Berk. & Broome) Sacc., Syll. Fung. I, p. 298. 1882.

≡ ***Nummularia pithodes*** (Berk. & Broome) Cooke, Grevillea 12: 8. 1883.

≡ ***Hypoxylon pithodes*** (Berk. & Broome) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 113. 1961.

≡ ***Numulariola pithodes*** (Berk. & Broome) P. Martin, J. S. African Bot. 35: 309. 1969.

= ***Nummularia fuscodisca*** Pat., Bull. Soc. Mycol. France 31: 35. 1915.

Illustration: Miller (1961, Fig. 219) [as ***Hypoxylon pithodes***].

Stromata applanate, fragmentary, ca. 2 mm thick; outer dehiscing layer white, thin; mature surface dark brown; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia tubular, 0.3–0.4 mm diam x 1.8–2 mm high. Ostioles higher than stromatal surface, with openings coarsely papillate. Asci not observed. Ascospores dark brown, ellipsoid-inequilateral, with one end narrowly rounded and the other bearing a hyaline cellular appendage 1.5–2 μm long x 4-5.5 μm broad, smooth, 22–33 (not including appendage) x 12.5–15.5 μm, with straight, broad, faint germ slit spore-length on more convex side.

Cultures and anamorph have been described by Martin (1969) on 2% malt agar. He described a seemingly ***Periconiella***-like conidiogenous structure as defined by Ju and Rogers (1996) with a short, smooth-walled main axis.

SPECIMENS EXAMINED: NEW CALEDONIA: Magenta prope Noumea, 1908, Le Rat, M. 113, corticated wood, as ***Hypoxylon fuscodiscum*** Pat., *ined.* (FH, HOLOTYPE of ***Nummularia fuscodisca***). SRI LANKA: Thwaite, G. H. K. 1867, wood, as ***Sphaeria pithodes*** Berk. & Broome, *ined.* (K, HOLOTYPE of ***Diatrype pithodes***).

NOTES: This fungus is characterized by a white outer dehiscing stromatal layer, coarsely papillate ostioles, and large, appendaged ascospores. The type material of ***B. pithodes*** at K is depauperate. The observation of the white outer dehiscing stromatal layer is based on the type material of ***Nummularia fuscodisca***. See also NOTES on ***B. philippinensis***.

Biscogniauxia plana (Petch) Y.-M. Ju & J. D. Rogers, *comb. nov.*
Figs. 29 & 30

≡ **Nummularia plana** Petch, Ann. Roy. Bot. Gard. Peradeniya 8: 166. 1924.

Stromata applanate, 0.5–6 cm long x 0.5–4 cm broad x 0.5–0.6 mm thick; outer dehiscing layer dark brown, thin; mature surface black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia tubular, ca. 0.05 (–0.1) mm diam x 0.3–0.5 mm high, with numerous individuals arranged in rosettes and discharging through a single ostiolar canal. Ostioles slightly lower than to slightly higher than stromatal surface, with openings punctate or slightly papillate. Asci 90–115 μm total length x 8–9 μm broad, the spore-bearing part 80–95 μm long, the stipes 10–20 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1–2 μm high x 2.5 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid, nearly equilateral, with narrowly to, less frequently, broadly rounded ends, smooth, 11–14 x 5.5–7.5 μm, with straight germ slit spore-length.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 2–2.5 wk, at first white, felty, azonate, with diffuse margins, becoming overlain with greenish olivaceous (90) patches. Reverse citrine (13) or greenish olivaceous (90), becoming olivaceous black (108). Sporulating regions, conidiogenous structure, conidiophores, conidiogenous cells, and conidia are much as those of **B. capnodes**.

SPECIMENS EXAMINED: CHINA: Hainan, Tan-hsien, 22.X.1934, Deng, S. Q. 5499, wood, as **Nummularia asarcodes** (GZU-Petrak 10356). PHILIPPINES: Palawan, Lake Monguao, IV.1913, Merrill, E. D. 8950, wood, as **Nummularia glycyrrhiza** by Sydow (GZU-Petrak 1451). SRI LANKA: Hakgala, I.1914, Petch, T. 3932, wood (K, ISOTYPE of **Nummularia plana**). TAIWAN: Taipei City, campus of National Taiwan Univ., 6.II.1988, Ju, Y.-M. 77020605 (CULTURED), dead wood of **Cinnamomum camphora** (JDR; NTU).

NOTES: This fungus is like **B. communapertura** in having a number of perithecia sharing a common ostiolar canal. **Biscogniauxia communapertura** differs in having coarsely papillate ostiolar openings, in having a larger perithecial diameter, in having smaller, paler ascospores, and in having a much less than spore-length germ slit. The basionym **Nummularia plana** was considered to be a synonym of **Hypoxylon nummularium** *var.* **pseudopachyloma** by Miller (1961). The latter name is considered to be a synonym of **B. capnodes** herein. **Biscogniauxia plana** is similar to **B. capnodes** in the stromatal surface and ascospore morphology, but differs from the latter in having perithecia arranged in rosettes. It differs from all other **Biscogniauxia** species in the extremely narrow perithecia.

Biscogniauxia plumbea Y.-M. Ju & J. D. Rogers, *sp. nov.*
Figs. 13, 14, 54, & 62

Etymology: Refers to the stromatal surface color.

Stromata applanata, usque ad 10 cm longa x 0.5–3.5 cm lata x 0.4–0.6 mm crassa; stratum externum fuscum tenue; superficies matura plumbea vetustate nigrella; textura proxime sub superficie et inter perithecia carbonacea; textura sub peritheciis inconspicua. Perithecia obovoidea, 0.1–0.2 mm diam x 0.2–0.3 mm alta. Ostiola subtiliter papillata. Asci 100–120 µm longitudine tota x 7–8 µm crassi, partibus sporiferis 85–100 longitudine, stipitibus 15–27 µm longitudine, annulo apicali in liquore iodato Melzeri cyanescente, cubico, 3 µm alto x 3 µm lato. Ascosporae brunneae, ellipsoideae inequilaterales vel fere equilaterales, uno extremo angustato vel lato, altero extremo appendice hyalina cellulosa 1.5–2 µm longa x 1-2 µm lata praedito, leves, 12–14.5 (appendice exclusa) x 6–7 µm, rima germinativa longa recta in latere plus minusve convexo praeditae.

Stromata applanate, up to 10 cm long x 0.5–3.5 cm broad x 0.4–0.6 mm thick; outer dehiscing layer dark brown, thin; mature surface gray, blackened in age; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.1–0.2 mm diam x 0.2–0.3 mm high. Ostioles slightly higher than stromatal surface, with openings finely papillate. Asci 100–120 µm total length x 7–8 µm broad, the spore-bearing part 85–100 µm long, the stipes 15–27 µm long, with apical ring bluing in Melzer's iodine reagent, cubical, 3 µm high x 3 µm broad. Ascospores brown, ellipsoid, inequilateral to nearly equilateral, with one end narrowly to broadly rounded and the other bearing a hyaline cellular appendage ca. 1.5–2 µm long x 1-2 µm broad, smooth, 12–14.5 (not including appendage) x 6–7 µm, with straight, spore-length germ slit on either more convex or less convex side.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 1.5 wk, at first vinaceous buff (86), finely plumose, appressed, azonate, with diffuse margins, becoming cottony, grayish to blackish. Reverse olivaceous black (108). Sporulating regions scattered over entire surface of colony but more abundant at edges, whitish. Conidiogenous structure with ***Periconiella***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores brownish, coarsely roughened, composed of a main axis, 3–5 µm broad, and less frequently one or more major branches, the branches terminating with three to six conidiogenous cells arising in whorls from the main axis and/or from major branches or from additional subordinate branches; additional branches infrequently produced. Conidiogenous cells short cylindrical, hyaline to yellowish, finely roughened, 7–10 x 3–4 µm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, obvoid to ellipsoid, 4–5 x 3–3.5 µm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: U.S.A.: Hawaiian Islands, Maui, Maluhia, 15.I.1996, Rogers, J. D., (CULTURED), guava wood (WSP, HOLOTYPE of ***Biscogniauxia plumbea***).

NOTES: The gray mature stromatal surface distinguishes this fungus from other ***Biscogniauxia*** taxa with appendaged ascospores.

Biscogniauxia pruni Granmo, Laessøe, & Scheuer, *nom. prov.*

Figs. 55 & 64

Stromata raised-discoid, more or less plane, solitary or confluent, 0.5–1.5 cm diam x 1–1.5 mm thick, with dark brown, distinct raised margins originating from outer dehiscing layer; mature surface black; black and slightly brittle immediately beneath surface; dark brown, woody between perithecia; tissue beneath perithecia composed largely of whitened host tissue; tissue of margins 0.2 mm thick, carbonaceous. Perithecia ovoid, 0.3–0.5 mm diam x 0.8 mm high. Ostioles lower than stromatal surface, with opening punctate. Asci 115–130 μm total length x 6–7.5 μm broad, the spore-bearing parts 70–110 μm long, the stipes 25–45 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1.5–2.5 μm high x 4.5 μm broad. Ascospores brown, unicellular, ellipsoid, slightly inequilateral to equilateral, with narrowly to broadly rounded ends, smooth, 10.5–14.5 x 5–7 μm, with straight germ slit less than spore-length to nearly spore-length usually on less convex side.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 2 wk, at first white, felty, azonate, with diffuse margins, becoming honey (64) or hazel (88). Reverse uncolored. Sporulating regions scattered over entire surface of colony, buff-colored. Conidiogenous structure with ***Nodulisporium***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores yellowish to pale brown, roughened, dichotomously branched, sometimes with additional branches arising from the first level of conidiogenous regions, 3–3.5 μm diam, with two to three conidiogenous cells arising from each terminus. Conidiogenous cells cylindrical, hyaline, finely roughened, 9–22 x 2.5–3 μm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, obvoid to ellipsoid, 4.5–5.5 x 3.2–4 μm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: AUSTRIA: Steiermark, Bad Radkersburg, near the river Mur, S of Laafeld, 205 m alt., 22.II.1995, Maurer, W. & Scheuer, C., Scheuer 3139 (CULTURED), bark of ***Prunus padus*** (JDR, *ex* GZU). LATVIA: Vidzeme, Lielvärde, 28.V.1933, Kirulis, A. 446, bark of ***Prunus padus***, as ***Nummularia bulliardi*** (BPI, *ex* Kirulis herb.), as ***Nummularia repanda*** (GZU-Petrak 1484); Vidzeme, Kr. Riga, Sigulda, im Walde, 12.IX.1935, Smarods, J., Fung. Latvici Exs. 633, bark of ***Prunus padus***, as ***Nummularia bulliardi*** (W 18370).

NOTES: This is a distinctive taxon, not yet published. We thus use a provisional name furnished by the future authors. This fungus is reported to be a specific inhabitant of ***Prunus***. There are numerous collections known from Lithuania, Poland, and other parts of the general region. Also see NOTES on ***B. africana***.

Biscogniauxia querna Pouzar, Česká Mykol. 40: 4. 1986.
Figs. 22, 23, & 51

Stromata raised-discoid, with slightly concave surface, 0.8–1.1 cm long x 0.4–0.7 cm broad x 2.5 mm thick, with dark brown, distinct raised margins originating from outer dehiscing layer; mature surface gray; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia composed largely of whitened host tissue, ca. 0.5 mm thick; tissue of margins 0.3–0.4 mm thick, dark brown, woody, with embedded black, carbonaceous fragments. Perithecia tubular, 0.4–0.5 mm diam x 1.5–2 mm high. Ostioles higher than stromatal surface, with openings coarsely papillate. Asci 170–210 μm total length x 16–19 μm broad, the spore-bearing parts 150–180 μm long, the stipes 10–30 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 2–2.5 μm high x 8–8.5 μm broad. Ascospores dark brown, unicellular, ellipsoid to subglobose, nearly equilateral, laterally compressed, with broadly rounded ends, smooth, 17–22 x 11–14 x 9–10 μm, with straight germ slit spore-length on both narrow edges.

Anamorph unknown.

SPECIMEN EXAMINED: CZECH REPUBLIC: Moravia, "Randezvous" apud Valtice, 17.IX.1984, Pouzar, Z., bark of ***Quercus*** (PR 842701, HOLOTYPE of ***Biscogniauxia querna***).

NOTES: ***Biscogniauxia querna*** is like ***B. schweinitzii*** in having ascospores that are laterally compressed and in having the ascospore germ slit on both narrow edges. They differ primarily in ascospore size and ostiolar morphology.

Biscogniauxia repanda (Fr.: Fr.) Kuntze, Rev. Gen. Plant. 2: 398. 1891.
Fig. 52

≡ ***Sphaeria repanda*** Fr., Observ. Mycol. I, p. 168. 1815; Fr.: Fr., Syst. Mycol. II, p. 346. 1823.
≡ ***Hypoxylon repandum*** (Fr.: Fr.) Fr., Summa Veg. Scand. II, p. 383. 1849.
≡ ***Nummularia repanda*** (Fr.: Fr.) Nitschke, Pyren. Germ., p. 57. 1867.
≡ ***Numulariola repanda*** (Fr.: Fr.) House, New York State Mus. Bull. 266: 50. 1925.
≡ ***Nummulariella repanda*** (Fr.: Fr.) Eckblad & Granmo, Norwegian J. Bot. 25: 70. 1978.
= ***Nummularia pezizoides*** Ellis & Everh., Bull. Torrey Club 11: 74. 1884.
    ≡ ***Biscogniauxia pezizoides*** (Ellis & Everh.) Kuntze, Rev. Gen. Plant. 2: 398. 1891.

Illustration: Jong and Benjamin (1971) [as ***Nummularia repanda***]; Granmo et al. (1989).

Stromata raised-discoid, with concave surface, 0.3–1.5 cm diam x 2–2.5 mm thick, with dark brown, distinct raised margins originating from outer dehiscing layer; mature surface black; dark brown, woody immediately beneath surface and between perithecia, with carbonaceous tissue encasing each individual ostiole; tissue beneath perithecia 1–1.7 mm thick, composed of whitish, coriaceous fungal tissue mixed with plant tissue; tissue of margins and bottoms 0.2–0.3 mm thick, dark brown, woody, with embedded carbonaceous fragments. Perithecia tubular, 0.2–0.4 mm diam x 0.8–1.5 mm high. Ostioles higher than stromatal surface with openings coarsely papillate or, less frequently, at the same level as stromatal surface. Asci 70–120 μm total length x 5–6 μm broad, the spore-bearing parts 60–100 μm long, the stipes 10–25 μm long, with apical ring bluing at base in Melzer's iodine reagent, discoid, 2 μm high x 2.5–3 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid to fusoid, nearly equilateral, with narrowly rounded ends, smooth, (8–) 9–14 x (4–) 4.5–6 μm, with straight germ slit spore-length on both sides.

Cultures and anamorph have been described and illustrated by Callan and Rogers (1986) on potato dextrose agar with 5g/L yeast extract. The conidiogenous structure is ***Nodulisporium***-like as defined in Ju and Rogers (1996).

SPECIMENS EXAMINED: CANADA: Ottawa, X.1883, Macoun, J., decorticated wood (NY [6 pts.], HOLOTYPE of ***Nummularia pezizoides***). NORWAY: Troms, Tromsø, Kroken, 10.VI.1989, Granmo, A., wood of ***Sorbus aucuparia*** (TROM); Finnmark, Alta, 24.VIII.1984, Granmo, A. & Johansen, B., wood of ***Sorbus aucuparia*** (TROM). RUSSIA: Primorsky Terr., reserve Ussuriysky, 27.VIII.1989, Vasilyeva, L. N., corticated wood of ***Malus***, as ***Biscogniauxia mandshurica*** by Vasilyeva, L. N. (VLA); Primorsky Terr., vic. of Anisimovka, 1.IX.1993, Vasilyeva, L. N., corticated wood of ***Malus mandshurica***, as ***Biscogniauxia mandshurica*** by Vasilyeva, L. N. (VLA). SWEDEN: Scleromyceti Sueciae Exs. 1, wood (UPS, TYPE of ***Sphaeria repanda***). U.S.A.: Illinois, Champaign Co., Allerton Park, 20.III.1982, Glawe, D. A. 82-2, wood (JDR). LOCALITY UNKNOWN: Rehm's Ascomycet. Exs. 1643, wood, as ***Nummularia repanda*** (GZU-Petrak 1483).

NOTES: ***Biscogniauxia repanda*** is one of the five ***Biscogniauxia*** species with each individual ostiole encased by carbonaceous stromatal tissue. The other four species are ***B. arima***, ***B. cinereolilacina***, ***B. marginata***, and ***B. simplicior***.

Biscogniauxia reticulospora Y.-M. Ju & J. D. Rogers, *sp. nov.*

Figs. 5, 6, 34, & 57

Etymology: Refers to the reticulate rims on the ascospore.

Stromata applanata, 5 cm longa x 2.5 cm lata x 1.5 mm crassa; stratum externum dehiscens fuscum tenue; superficies matura nigra; textura proxime sub superficie et inter perithecia carbonacea; textura sub peritheciis inconspicua. Perithecia tubularia, 0.3 mm diam x 1–1.3 mm alta. Ostiola papillata vel grosse papillata. Asci fracti, annulo apicali in liquore iodato Melzeri cyanescente, discoideo, 5 μm alto x 7 μm lato. Ascosporae fuscae, unicellulares, ellipsoideo-inequilaterales, apicibus angustatis, reticulatae, 27–34 x 14–15.5 μm, rima germinativa recta longa in latere convexiori praeditae.

Stromata applanate, 5 cm long x 2.5 cm broad x 1.5 mm thick; outer dehiscing layer dark brown, thin; mature surface black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia tubular, 0.3 mm diam x 1–1.3 mm high. Ostioles higher than stromatal surface, with openings papillate or coarsely papillate. Asci fragmentary, with apical ring bluing in Melzer's iodine reagent, discoid, 5 μm high x 7 μm broad. Ascospores dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, ornamented with shallow reticulations, 27–34 x 14–15.5 μm, with straight germ slit spore-length on more convex side.

Anamorph unknown.

SPECIMEN EXAMINED: THAILAND: Khao Lau Nakorn Nayok, 21.VIII.1993, Bandoni, R. J. & A. A., & Flegel, T. W., KY-93-4 #41, corticated wood (WSP, HOLOTYPE of ***Biscogniauxia reticulospora***).

NOTES: This is the only ***Biscogniauxia*** known to have reticulate ascospores. This might indicate a relationship with ***Camillea*** which has paler ascospores that lack a germ slit. Unfortunately, we were unable to obtain cultures.

Biscogniauxia schweinitzii Y.-M. Ju & J. D. Rogers, *nom. nov.*

Figs. 25–28

≡ ***Sphaeria macula*** Schwein., Schrift. Naturf.-Ges. Leipzig I, p. 31. 1822; *non* Tode, 1791; [*nom. rejic.*, Art. 53.1].

≡ ***Nummularia macula*** (Schwein.) Cooke, Grevillea 12: 6. 1883.

≡ ***Hypoxylon maculum*** (Schwein.) J. H. Miller, Mycologia 33: 75. 1941.

≡ ***Numulariola macula*** (Schwein.) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

≡ ***Biscogniauxia macula*** (Schwein.) Van der Gucht, Mycotaxon 45: 265. 1992.

Illustrations: Miller (1961, Figs. 191 & 224) [as ***Hypoxylon maculum***].

Stromata erumpent, pulvinate, raised, 0.2–1.3 cm long x 0.2–0.5 cm broad x 0.6–1 mm thick, with sloped margins; mature surface black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.3–0.5 mm diam x 0.4–0.7 mm high. Ostioles lower than stromatal surface, with openings punctate, sometimes overlain with white substance. Asci 105–130 μm total length x 12–13 μm broad, the spore-bearing part 90-115 μm long, the stipes 15-25 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1.5–2 μm high x 5.5–6 μm broad. Ascospores dark brown, unicellular, ellipsoid to subglobose, nearly equilateral, laterally compressed, with broadly rounded ends, smooth, 13–14.5 x 8.5–11.5 x 7–7.5 μm, with straight germ slit spore-length on both narrow edges.

Anamorph unknown.

SPECIMENS EXAMINED: U.S.A.: corticated wood (K 32208, LECTOTYPE [selected here] of ***Sphaeria macula*** Schwein.); Florida, Old Faithful Spa, 30.XII.1940, Shear, C. L., wood, as ***Hypoxylon maculum*** by Miller, J. H. (BPI 590093); South Carolina, Santee Rio, 6.X.1923, Shear, C. L., wood, as ***Hypoxylon maculum*** by Miller, J. H. (BPI 590092).

NOTES: We erect a *nomen novum* for Schweinitz's ***S. macula*** because it is a later homonym of Tode's species. Tode's ***S. macula*** was listed as a synonym of ***Hypoxylon serpens*** (Pers.: Fr.) J. Kickx fil. by Miller (1961). We were unable to locate type material of ***S. macula*** Schwein. at PH. At the

Curtis herbarium of FH, a Schweinitz specimen labelled under this name was found; no detailed collecting data were given to it. It is a ***Nemania*** species. There is another Schweinitz specimen at K; this is selected as the lectotype because it reflects the current concept of this name (e.g., Miller, 1961; Van der Gucht, 1992). The lectotype has an ascospore morpholgy highly similar to that of ***B. querna*** except for having a smaller size range. ***Biscogniauxia schweinitzii*** differs from ***B. querna*** also in having punctate ostiolar openings. Miller (1961) gave the ascospore size range as 12–17 x 9–13 µm. Van der Gucht (1992, 1995) recently redescribed this fungus from Papua New Guinea and gave the ascospore size range as 13.5–15 x 8.5–11.5 µm.

Biscogniauxia simplicior Pouzar, Česká Mykol. 33: 210. 1979.

Figs. 19 & 67

Stromata raised-discoid, with concave surface, 1–2.2 cm diam x 2.5–3 mm thick, with dark brown, distinct raised margins originating from outer dehiscing layer; mature surface black; dark brown, woody immediately beneath surface and between perithecia, with carbonaceous tissue encasing each individual ostiole; tissue beneath perithecia 1 mm thick, composed of white, coriaceous fungal tissue and embedded carbonaceous fragments; tissue of margins and bottoms 0.3–0.4 mm thick, dark brown, woody, with embedded carbonaceous fragments. Perithecia tubular, 0.3–0.4 mm diam x 0.7–1.5 mm high. Ostioles at the same level as or lower than stromatal surface, with openings punctate, sometimes overlain with white substance. Asci 120–155 µm total length x 7–8 µm broad, the spore-bearing parts 95–125 µm long, the stipes 25–35 µm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1 µm high x 2.5–3 µm broad. Ascospores brown, unicellular, ellipsoid to fusoid, nearly equilateral, with narrowly rounded ends, smooth, 13–17.5 x 5–6.5 µm, with straight germ slit spore-length.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 3 wk, at first white, felty, azonate, with diffuse margins, becoming isabelline (65), floccose from center outwards. Reverse uncolored. Sporulating regions scattered over entire surface of colony, hazel (88). Conidiogenous structure with ***Nodulisporium***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores pale brown, smooth or slightly roughened, dichotomously branched, infrequently with additional branches arising from the first level of conidiogenous regions, 3–3.5 µm diam, with two to three conidiogenous cells arising from each terminus. Conidiogenous cells cylindrical, hyaline, smooth, 15–30 x 3–3.5 µm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid to short cylindrical, 8–13 x 2.5–3 µm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: CZECH REPUBLIC: Bohemia, 18.IX.1977, Kotlaba, F. & Pouzar, Z., wood of ***Rhamnus cathartica*** (PR 813733, HOLOTYPE of ***Biscogniauxia simplicior***). FRANCE: Roquebrune Montseron, III.1995, Candoussau, F. 5354A (CULTURED), wood of ***Rhamnus cathartica*** (JDR).

NOTES: There are five **Biscogniauxia** species having individual ostioles encased by carbonaceous stromatal tissue. Among them, ***Biscogniauxia simplicior***, ***B. marginata***, and ***B. repanda*** have raised-discoid stromata, whereas ***B. cinereolilacina*** and ***B. arima*** have applanate stromata. ***Biscogniauxia simplicior*** differs from ***B. repanda*** in having a germ slit on one side, rather than both sides, of the ascospore; differs from ***B. marginata*** in not having a sigmoid ascospore germ slit. The collection data suggest a host specificity for ***Rhamnus*** species.

Biscogniauxia sinuosa (Theiss.) Y.-M. Ju & J. D. Rogers, *comb. nov.* Fig. 58

≡ ***Nummularia sinuosa*** Theiss., Ann. Mycol. 6: 349. 1908.

≡ ***Hypoxylon sinuosum*** (Theiss.) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 128. 1961.

≡ ***Numulariola sinuosa*** (Theiss.) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 79. 1976.

Illustrations: Miller (1961, Figs. 199 & 235) [as ***Hypoxylon sinuosum***].

Stromata applanate, up to 2.3 cm long x 0.6–1.2 cm broad x 0.6 mm thick; outer dehiscing layer dark brown, thin; mature surface black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.3–0.4 mm diam x 0.4–0.5 mm high. Ostioles at the same level as or lower than stromatal surface, with openings punctate, sometimes overlain with white substance. Asci fragmentary, with apical ring bluing in Melzer's iodine reagent, discoid, 3.5–4 μm high x 5.5–6 μm broad. Ascospores dark brown, unicellular, fusoid, slightly inequilateral, with acute to narrowly rounded ends, ornamented with longitudinal ridges, 26–30 x 7.5–10 μm, with straight germ slit spore-length.

Anamorph unknown.

SPECIMENS EXAMINED: BRAZIL: Rick, J., corticated wood (GAM 12815 *ex* BPI 10570, TYPE of ***Nummularia sinuosa***); 1927, Rick, J., .wood, as ***Nummularia*** *sp.* (GZU-Petrak 1422).

NOTES: The longitudinal ridges on the ascospore were not mentioned by Miller (1961).

Biscogniauxia uniapiculata (Penz. & Sacc.) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990. Fig. 61

≡ ***Nummularia uniapiculata*** Penz. & Sacc., Malpighia 11: 494. 1897.

≡ ***Hypoxylon uniapiculatum*** (Penz. & Sacc.) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 111. 1961.

≡ ***Numulariola uniapiculata*** (Penz. & Sacc.) P. Martin, J. S. African Bot. 35: 307. 1969.

= ***Nummularia papyracea*** Rehm, Leafl. Philipp. Bot. 6: 2208. 1914.

≡ ***Hypoxylon papyraceum*** (Rehm) J. H. Miller *apud* Chardon & Toro, Mycol. Explor. Venezuela, Monogr. Univers. Puerto Rico, ser. B., 2: 202. 1934.

Illustration: Miller (1961, Fig. 217) [as ***Hypoxylon uniapiculatum***].

Stromata applanate, 0.5–6 cm long x 0.5–4 cm broad x 0.4–0.7 mm thick; outer dehiscing layer dark brown, thin; mature surface black; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.2–0.3 mm diam x 0.3–0.6 mm high. Ostioles at the same level as or lower than stromatal surface, with openings punctate, usually surrounded by slightly raised rim, sometimes overlain with white substance. Asci 75–130 μm total length x 5.5–7 μm broad, the spore-bearing part 65–105 μm long, the stipes 10–30 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 2.5–3 μm high x 3.5 μm broad. Ascospores brown, ellipsoid, inequilateral to nearly equilateral, with one end narrowly to broadly rounded and the other bearing a hyaline or pale brown cellular appendage 2-2.5 μm long x 2-3 μm broad, smooth, (9–) 10–14 (not including appendage) x 5–7 μm, with straight, spore-length or, less frequently, slightly less than spore-length germ slit on either more convex or less convex side.

Colonies on 2% Difco oatmeal agar at ca. 20°C and under 12 h fluorescent light reaching the edge of 9 cm Petri dish in 3 wk, at first white, felty, faintly zonate, with diffuse margins, becoming flesh (37) and eventually overlain with a blackish stromatic layer. Reverse uncolored. Sporulating regions scattered over entire surface of colony, whitish to grayish. Conidiogenous structure with ***Periconiella***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores brownish, slightly roughened, composed of a main axis, 3.5–5.5 μm broad, and sometimes one or more major branches, branches terminating with three to five conidiogenous cells arising in whorls from the main axis and/or from major branches or from additional subordinate branches; additional branches infrequently produced. Conidiogenous cells cylindrical, hyaline to yellowish, finely roughened, 8–18 x 2.5–3.5 μm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid to short cylindrical, (5.5–) 6.5–7.5 (–8) x (2–) 2.5–3 μm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: MALAYSIA: Sarawak, Beccari, O. 252, corticated wood, as ***Hypoxylon stigmoideum*** (RO). INDONESIA: Java, Tjibodas, 4.II.1897, no. 159, wood (PAD, HOLOTYPE; BPI 716902 [Lloyd herb. 11299], ISOTYPE of ***Nummularia uniapiculata***); North Sulawesi, Dumoga-Bone National Park, at the confluence of the Toraut and Tumpah Rivers, vic. Project Wallace Base Camp, elev. 211 m, IX.1985, Samuels, G. J. 1970, wood, as ***Hypoxylon uniapiculatum*** (JDR). PHILIPPINES: Los Baños, 10.XI.1913, Baker, C. F. 2008 (mistakenly cited as "2000" in the protologue), dead stump (S, HOLOTYPE of ***Nummularia papyracea***); Mt. Maquiling, XI.1913, Baker, C. F., Fung. Malayana 576, stump, as ***Nummularia papyracea*** by Sydow (GZU-Petrak 1464); Mt. Maquiling, VI.1914, Baker C. F., Fung. Malayana 170, fallen branches, as ***Nummularia scutata*** by Rehm, H. (W 14778) . PUERTO RICO: Maricao, IV.1974, Rogers, J. D., wood (JDR). TAIWAN: Taipei City, Young-ming-shan, 14.VII.1988, Ju, Y.-M. 77071406 (CULTURED), corticated wood (JDR; NTU). U.S.A.: Hawaiian Islands, Maui, Kailua, 18.XII.1908, Lyon, wood of

Metrosideros polymorpha, as ***Nummularia mauritanica*** by Rehm, H. (BISH 602441); Hawaiian Islands, Oahu, Manoa, HSPA Arboretum, 26.XII.1945, Kendall, K. et al., bark, as ***Hypoxylon papyraceum*** by Miller, J. H. (BISH 145865); Hawaiian Islands, Oahu, HSPA Forest Plantation, Manoa Valley, Honolulu, 3.XI.1939, Bessey 23, bark of ***Acacia koa***, as ***Hypoxylon*** *sp.* by Goos (BISH 580573); Hawaiian Islands, Molokai, Kamachou Park, 12.I.1996, Rogers, J. D., wood of ***Eucalyptus*** (JDR); Hawaiian Islands, Maui, Maluhia, 15.I.1996, Rogers, J. D., wood of ***Aleurites moluccana*** (JDR); Hawaiian Islands, Kauai, Kokee Park, 8.I.1996, Rogers, J. D., wood of ***Psidium cattleianum*** (JDR).

NOTES: The anamorph that we obtained is much as that described and illustrated by Martin (1969) [as ***Numulariola uniapiculata***] on 2% malt agar except for having somewhat longer conidia, (5.5–) 6.5–7.5 (–8) x (2–) 2.5–3 µm vs. 3.4–5.7 x 2.3–3.4 µm. See also NOTES on ***B. grenadensis***.

Biscogniauxia uniapiculata (Penz. & Sacc.) Whalley & Laessøe *var.* ***indica*** (Sacc.) Y.-M. Ju & J. D. Rogers, *comb. nov.* Fig. 56

≡ ***Nummularia punctulata*** (Berk. & Ravenel) Sacc. *var.* ***indica*** Sacc., Bull. Orto Bot. Napoli 24: 10. 1918.

The teleomorph is much like that of the typical variety except in consistently having a longer ascospore appendage, 2.5–4 µm, in having a less than spore-length germ slit, and in having more frequently inequilateral and somewhat broader ascospores, 10–12 (not including appendage) x 6–7.5 (–8.5) µm.

Anamorph unknown.

SPECIMEN EXAMINED: SINGAPORE: Botanic Garden, X.1917, Baker, C. F. 5371, corticated wood of ***Gluta benghas*** (Anacardiaceae) (PAD, HOLOTYPE of ***Nummularia punctulata*** *var.* ***indica***).

Biscogniauxia uniapiculata (Penz. & Sacc.) Whalley & Laessøe *var.* ***macrospora*** (J. D. Rogers) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990.

≡ ***Hypoxylon uniapiculatum*** (Penz. & Sacc.) J. H. Miller *var.* ***macrosporum*** J. D. Rogers, Mycologia 67: 1063. 1975.

The teleomorph is much like that of the typical variety except in consistently having a less than spore-length germ slit, in having more frequently inequilateral ascospores, and in having a larger ascospore size range, 13–15.5 (not including appendage) x 7.5–10 µm. Ascospore appendages are 2–3 µm long.

Anamorph unknown.

SPECIMEN EXAMINED: PUERTO RICO: El Verde, IV.1974, Rogers, J. D., wood (WSP 60000, HOLOTYPE of ***Hypoxylon uniapiculatum*** *var.* ***macrosporum***).

Biscogniauxia waitpela Van der Gucht, Mycol. Res. 100: 704. 1996. Fig. 53

Illustrations: Van der Gucht (1996).

Stromata applanate, 2.5–8 cm long x 1–3.5 cm broad x 0.3 mm thick; outer dehiscing layer dark brown, thin; mature surface light orange brown; whitish soft immediately beneath surface; tissue between perithecia carbonaceous; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.1 mm diam x 0.2 mm high. Ostioles lower than stromatal surface, with openings umbilicate and sometimes overlain with white substance. Asci 60–75 µm total length x 4–5 µm broad, the spore-bearing parts 50–65 µm long, the stipes 7–12 µm long, with apical ring bluing in Melzer's iodine reagent, discoid, 0.5 µm high x 2 µm broad. Ascospores pale brown to light brown, ellipsoid, nearly equilateral, with one end broadly to, less frequently, narrowly rounded and the other bearing a hyaline cellular appendage ca. 1 µm long x 2-2.5 µm broad, smooth, 6–7.5 (not including appendage) x 3.5–4 µm, lacking germ slit.

Anamorph unknown.

SPECIMENS EXAMINED: PAPUA NEW GUINEA: Madang Province, Awar, 20.V.1992, Van der Gucht, K. & De Meester, L., dead wood (GENT 92-1144, HOLOTYPE of ***Biscogniauxia waitpela***). PHILIPPINES: Mt. Maquiling, 28.IX.1920, Fells, A., corticated wood of ***Artocarpus***, as ***Nummularia** sp.* (GZU-Petrak 1412); Mt. Maquiling, 28.IX.1920, Fells, A., *ex* Lloyd herb., corticated wood, as ***Nummularia** sp.* (GZU-Petrak 2110); Reinking, O. A., *ex* Lloyd herb., corticated wood, as ***Nummularia** sp.* (GZU-Petrak 2116).

NOTES: The grayish brown to light orange brown mature stromatal surface is unique among ***Biscogniauxia*** taxa. This fungus has fairly small, light-colored ascospores which apparently lack a germ slit.

Biscogniauxia weldenii (J. D. Rogers) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990.

≡ ***Hypoxylon weldenii*** J. D. Rogers, Canad. J. Bot. 55: 372. 1977.

Illustrations: Rogers (1977).

See Rogers (1977) for a description of the teleomorph. Ascospores are (22–) 25–28 (–30) (not including appendage) x (8–) 9.5–10.5 (–12) µm, with an appendage 1.5–7 µm long x 4-5 µm broad, and ornamented with striations.

Anamorph unknown.

SPECIMEN EXAMINED: U.S.A.: Louisiana, St. Tammany Parish, near Pearl River, Honey Island swamp, 6.VI.1976, Rogers, J. D., wood (WSP 60855, HOLOTYPE of ***Hypoxylon weldenii***).

NOTES: ***Biscogniauxia weldenii*** and its small-spored variety, ***microspora***, are characteristic in having striate ascospores.

Biscogniauxia weldenii (J. D. Rogers) Whalley & Laessøe *var.* ***microspora*** (J. D. Rogers) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990.

≡ ***Hypoxylon weldenii*** J. D. Rogers, *var.* ***microsporum*** J. D. Rogers, Mycologia 72: 829. 1980.

The teleomorph differs from that of the typical variety in having a smaller ascospore size range, (17–) 18–21 (not including appendage) x (7–) 8–10 (–11) µm.

Anamorph unknown.

SPECIMEN EXAMINED: HONDURAS: Zamorano, VI.1977, Rogers, J. D. & Grove, M., wood (WSP 63898, HOLOTYPE of ***Hypoxylon weldinii var. microsporum***).

Biscogniauxia zelandica Y.-M. Ju & J. D. Rogers, *sp. nov.* Figs. 12 & 59

Etymology: After New Zealand.

Stromata applanata, usque ad 13 cm longa x 2–4 cm lata x 0.5 mm crassa; stratum externum dehiscens fuscum tenue; superficies matura fusco-grisea; textura proxime sub superficie et inter perithecia carbonacea; textura sub peritheciis inconspicua. Perithecia obovoidea, 0.2 mm diam x 0.4 mm alta. Ostiola punctata. Asci 135–155 µm longitudine tota x 8.5–10 µm crassi, partibus sporiferis 125–140 µm longitudine, stipitibus 10–20 µm longitudine, annulo apicali in liquore iodato Melzeri cyanescente, discoideo, 1.5–2 µm alto x 3.5–4 µm lato. Ascosporae dilute brunneae vel brunneae, fusoideo-inequilaterales, uno extremo angustato, altero extremo appendice hyalina cellulosa 2–2.5 µm longa x 2–2.5 µm lata praedito, leves, (14–) 16–21 (appendice exclusa) x 5–6.5 µm, rima germinativa recta brevicula plerumque in latere minus convexo praeditae.

Stromata applanate, up to 13 cm long x 2–4 cm broad x 0.5 mm thick; outer dehiscing layer dark brown, thin; mature surface dark gray; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecia inconspicuous. Perithecia obovoid, 0.2 mm diam x 0.4 mm high. Ostioles lower than stromatal surface, with opening punctate. Asci 135–155 µm total length x 8.5–10 µm broad, the spore-bearing part 125–140 µm long, the stipes 10–20 µm long, with apical ring bluing in Melzer's iodine reagent, discoid, 1.5–2 µm high x 3.5–4 µm broad. Ascospores light brown to brown, fusoid-inequilateral, with one end narrowly rounded and the other bearing a hyaline cellular appendage 2–2.5 µm long x 2–2.5 µm broad, smooth, (14–) 16–21 (not including appendage) x 5–6.5 µm, with straight, less than spore-length germ slit usually on less convex side.

No cultures obtained. Anamorph found on the outer dehiscing layer of naturally-occurring stromata. Sporulating regions olivaceous (48). Conidiogenous structure with ***Periconiella***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores yellowish to brownish, coarsely roughened, composed of a main axis, 4–5 µm broad, and sometimes one or more major branches, the branches terminating with three to five conidiogenous cells arising in whorls from the main axis and/or from major branches or from additional subordinate branches; additional branches infrequently produced. Conidiogenous cells cylindrical, hyaline to yellowish, finely roughened, 10–15 x 3.5–5 µm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid, 4.5–6.5 x 2.5–3 μm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: NEW ZEALAND: Auckland, Swanson, 2.V.1954, Dingley, J. M., wood of ***Coprosma*** (PDD 16346, HOLOTYPE; WSP, ISOTYPE of ***B. zelandica***).

NOTES: Unlike ***B. uniapiculata var. indica*** and ***B. uniapiculata var. macrospora*** which also have a less than spore-length ascospore germ slit, this fungus has long, narrow ascospores with the germ slit usually on the less convex side.

LIST OF NAMES

Accepted or suggested disposition is indicated by an asterisk. Probable disposition is indicated by a question mark.

* ***africana*** (***Biscogniauxia***) Y.-M. Ju & J. D. Rogers

alabatensis (***Nummularia***) Yates = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

albocincta (***Nummularia***) Rehm, Hedwigia 40: 142. 1901.
BRAZIL: Ule 2506, corticated twigs (S, HOLOTYPE of ***Nummularia albocincta***).
A penzigioid ***Xylaria***. Also see Ju and Rogers (1996).

* ***albosticta*** (***Biscogniauxia***) (Ellis & Morg.) Y.-M. Ju & J. D. Rogers ≡ ***Nummularia albosticta*** Ellis & Morg. ≡ ***Numulariola albosticta*** (Ellis & Morg.) P. Martin ≡ ***Hypoxylon albostictum*** (Ellis & Morg.) J. H. Miller

allantoideum (***Hypoxylon***) Cooke, Grevillea 8: 66. 1879; *non* (Berk.) Mont., 1845; [*nom. rejic.*, Art. 53.1].
Probably a ***Biscogniauxia***. The type was not located at K. Miller (1961), however, synonymized this name with ***Hypoxylon serpens*** (Pers.: Fr.) J. Kickx fil.

* ***anceps*** (***Biscogniauxia***) (Sacc.) J. D. Rogers, Y.-M. Ju, & Cand. ≡ ***Nummularia anceps*** Sacc.

annulata (***Nummularia***) Rehm, Ann. Mycol. 11: 399. 1913.
≡ * ***Hypoxylon stygium*** (Lév.) Sacc. *var.* ***annulatum*** (Rehm) Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 226. 1996.

anthracina (***Nummularia***) (Schmidt) Traverso ≡ ***Sphaeria anthracina*** Schmidt = * ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze

anthracina (***Nummularia***) (Schmidt) Traverso *var.* ***tiliaecola*** Rehm = * ***Biscogniauxia cinereolilacina*** (J. H. Miller) Pouzar

anthracodes (***Nummularia***) (Fr.: Fr.) Cooke, Grevillea 12: 7. 1883.
≡ ***Sphaeria anthracodes*** Fr., Linnaea 5: 544. 1830; Fr.: Fr., Syst. Mycol. Index, p. 159. 1832.
≡ ***Hypoxylon anthracodes*** (Fr.: Fr.) Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 123 (151). 1855.
We are uncertain about the application of this name. See also Ju and Rogers (1996). It is our impression, however, that it was applied to collections of ***Camillea tinctor*** that did not stain the underlying wood.

anthracodes (***Nummularia***) (Fr.: Fr.) Cooke *var.* ***gliricidiae*** Rehm, Leafl. Philipp. Bot. 6: 2209. 1914.

PHILIPPINES: Luzon, Prov. Laguna, Los Baños, 15.XII.1913, Baker, C. F. 2181, dead ***Gliricidia sepium*** (S, SYNTYPE of ***Nummularia anthracodes*** *var.* ***gliricidiae***).

= * ***Camillea tinctor*** (Berk.) Laessøe, J. D. Rogers, & Whalley

See also Ju and Rogers (1996).

* ***arima*** (***Biscogniauxia***) San Martín, Y.-M. Ju, & J. D. Rogers

artemisiae (***Nummularia***) (Schwein.) Sacc., Syll. Fung. I, p. 401. 1882.

≡ ***Sphaeria artemisiae*** Schwein., Trans. Amer. Philos. Soc., n. ser., 4: 194. 1832.

= * ***Dothidea puccinioides*** Fr.: Fr. *Fide* Farr et al. (1989).

artocarpi (***Nummularia***) Pat., Bull. Soc. Mycol. France 22: 56. 1906.

Patouillard (1906) mentioned a white stromatal interior for this fungus. It is possibly not a ***Biscogniauxia*** but a penzigioid ***Xylaria***.

artocreas (***Nummularia***) (Cooke & Massee) J. H. Miller, J. Dept. Agric. Univ. Puerto Rico 29: 63. 1946.

≡ ***Diatrype artocreas*** Cooke & Massee, Grevillea 21: 4. 1892.

≡ ***Nummularioidea artocreas*** (Cooke & Massee) C. G. Lloyd, Mycol. Writings 7: 1281. 1924.

≡ ***Camillea artocreas*** (Cooke & Massee) Rick, Brotéria, sér. Bot., 25: 38. 1931.

= * ***Camillea labellum*** Mont., Ann. Sci. Nat. Bot. sér. IV, 3: 113. 1855. *Fide* Laessøe et al. (1989).

asarcodes (***Nummularia***) Theiss. ≡ ***Hypoxylon asarcodes*** (Theiss.) J. H. Miller *ex* S. Teng = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

asarcodes (***Nummularia***) Theiss. f. ***griseoatra*** Theiss. = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

* ***atropunctata*** (***Biscogniauxia***) (Schwein.: Fr.) Pouzar ≡ ***Sphaeria atropunctata*** Schwein.: Fr. ≡ ***Diatrype atropunctata*** (Schwein.: Fr.) Berk. ≡ ***Anthostoma atropunctatum*** (Schwein.: Fr.) Sacc. ≡ ***Hypoxylon atropunctatum*** (Schwein.: Fr.) Cooke ≡ ***Nummularia atropunctata*** (Schwein.: Fr.) Höhn. ≡ ***Numulariola atropunctata*** (Schwein.: Fr.) House ≡ ***Albocrustum atropunctatum*** (Schwein.: Fr.) C. G. Lloyd

* ***atropunctata*** (***Biscogniauxia***) (Schwein.: Fr.) Pouzar *var.* ***intermedia*** Y.-M. Ju & J. D. Rogers

* ***atropunctata*** (***Biscogniauxia***) (Schwein.: Fr.) Pouzar *var.* ***maritima*** (Lar. N. Vasilyeva) Y.-M. Ju & J. D. Rogers

australis (***Nummularia***) Cooke ≡ ***Numulariola australis*** (Cooke) P. Martin = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers

bacillum (***Numulariola***) (Mont.) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.

≡ ***Thamnomyces bacillum*** Mont., Ann. Sci. Nat. Bot., sér. II, 8: 358. 1837.

≡ ***Hypoxylon bacillum*** (Mont.) Mont. *apud* Sagra, Fl. Cubana I, p. 210.

1853.
≡ ***Camillea bacillum*** (Mont.) Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 113. 1855.
≡ * ***Leprieuria bacillum*** (Mont.) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 152. 1989.

bacongoensis (***Nummularia***) Saccas, J. Agric. Trop. Bot. Appl. 1: 347. 1954.

Saccas's protologue and illustrations clearly indicate a ***Biscogniauxia***. We have not studied material of this fungus.

* ***baileyi*** (***Biscogniauxia***) (Berk. & Broome *ex* Cooke) Kuntze ≡ ***Nummularia baileyi*** Berk. & Broome *ex* Cooke

* ***bartholomaei*** (***Biscogniauxia***) (Peck) Lar. N. Vassiljeva ≡ ***Hypoxylon bartholomaei*** Peck ≡ ***Numulariola bartholomaei*** (Peck) P. Martin ≡ ***Nummularia bartholomaei*** (Peck) Lar. N. Vassiljeva

bilabiata (***Numulariola***) (Speg.) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; P. Martin, J. S. African Bot. 42: 76. 1976.
≡ * ***Camillea bilabiata*** Speg., Bol. Acad. Nac. Ci. 11: 509. 1889. *Fide* Laessøe et al. (1989).

broomeiana (***Nummularia***) (Berk. & M. A. Curtis) J. H. Miller, Mycologia 33: 77. 1941.
≡ ***Hypoxylon broomeianum*** Berk. & M. A. Curtis *apud* Berk., Grevillea 4: 94. 1876.
≡ ***Jongiella broomeiana*** (Berk. & M. A. Curtis) Morelet, Bull. Soc. Sci. Nat. Archeol. Toulon & du Var 196: 7. 1971.
≡ ***Numulariola broomeiana*** (Berk. & M. A. Curtis) P. Martin, J. S. African Bot. 35: 289. 1969; [*nom. inval.*, ICBN Art. 33.2]; P. Martin, J. S. African Bot. 42: 76. 1976.
≡ ***Camillea broomeiana*** (Berk. & M. A. Curtis) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 149. 1989.
= * ***Camillea obularia*** (Fr.) Laessøe, J. D. Rogers, & Lodge, Mycologia 83: 224. 1991.

bulliardi (***Biscogniauxia***) (Tul. & C. Tul.) Kuntze ≡ ***Nummularia bulliardi*** Tul. & C. Tul. ≡ ***Kommamyce bulliardi*** (Tul. & C. Tul.) Nieuwland ≡ * ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze

bulliardi (***Nummularia***) Tul. & C. Tul. *var.* ***minor*** Rehm = * ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze

bulliardi (***Nummularia***) Tul. & C. Tul. *var.* ***stenosperma*** Theiss. = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

bulliardi (***Nummularia***) Tul. & C. Tul. f. ***tiliae*** Rehm = * ***Biscogniauxia cinereolilacina*** (J. H. Miller) Pouzar

caespitosa (***Nummularia***) Pat., Bull. Soc. Mycol. France 4: 110. 1888. VENEZUELA: 8.IX.1887, Guillard 265, wood (K, TYPE of ***Nummularia caespitosa***).

Type material was not found at the Patouillard herbarium in FH. The material at K is a ***Kretzschmaria*** taxon.

caespitosa (***Nummularia***) Pat. *var.* ***areolata*** Rehm, Hedwigia 40: 141. 1901.

Type material was not found at S. However, Rehm's description and illustration indicate that this is a ***Kretzschmaria*** taxon.

* ***capnodes*** (***Biscogniauxia***) (Berk.) Y.-M. Ju & J. D. Rogers ≡ ***Sphaeria capnodes*** Berk. & Broome ≡ ***Diatrype capnodes*** (Berk.) Curr. ≡ ***Anthostoma capnodes*** (Berk.) Sacc. ≡ ***Hypoxylon capnodes*** (Berk.) Berk. & Broome *ex* Cooke

* ***capnodes*** (***Biscogniauxia***) (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***limoniispora*** Y.-M. Ju & J. D. Rogers

* ***capnodes*** (***Biscogniauxia***) (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers

* ***capnodes*** (***Biscogniauxia***) (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***theissenii*** (Syd. & P. Syd.) Y.-M. Ju & J. D. Rogers

carabayensis (***Nummularia***) (Mont.) Cooke, Grevillea 12: 8. 1883.

≡ ***Hypoxylon carabayense*** Mont., Ann. Sci. Nat. Bot., sér. IV, 5: 372. 1856.

≡ ***Penzigia carabayensis*** (Mont.) J. H. Miller, Monogr. of World Species of ***Hypoxylon***, p. 134. 1961.

Probably a penzigioid ***Xylaria***.

cercidicola (***Nummularia***) (Berk. & M. A. Curtis *ex* Peck) Dearn. & House, Circ. New York State Mus. 24: 42. 1940.

≡ ***Diatrype cercidicola*** Berk. & M. A. Curtis *ex* Peck, Annual Rep. New York state Mus. 25: 101. 1873.

≡ ***Anthostoma cercidicolum*** (Berk. & M. A. Curtis *ex* Peck) Sacc., Syll. Fung. I, p. 306. 1882.

≡ ***Hypoxylon rubiginosum*** (Pers.: Fr.) Fr. *var.* ***cercidicola*** (Berk. & M. A. Curtis *ex* Peck) L. E. Petrini *apud* L. E. Petrini & Müller, Mycol. Helv. 1: 533. 1986.

≡ * ***Hypoxylon cercidicolum*** (Berk. & M. A. Curtis *ex* Peck) Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 95. 1996.

cincta (***Nummularia***) Ferd. & Winge *apud* Raunk., Bot. Tidsskr. 29: 15. 1908.

≡ ***Numulariola cincta*** (Ferd. & Winge) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.

= * ***Camillea obularia*** (Fr.) Laessøe, J. D. Rogers, & Lodge. *Fide* Laessøe et al. (1989) and Rogers et al. (1991).

cincta (***Nummularia***) Ferd. & Winge *var.* ***centrafricana*** Saccas, J. Agric. Trop. Bot. Appl. 1: 349. 1954.

We have not studied material of this fungus.

cinerea (***Nummularia***) Pat., Bull. Herb. Boiss. 3: 68. 1895; *non* Rehm, 1918.

Probably ***Jumillera cinerea*** (Ellis & Everh.) J. D. Rogers, Y.-M. Ju, & San Martín (Rogers et al., 1997).

cinerea (***Nummularia***) Rehm *non* Pat. = * ***Biscogniauxia atropunctata*** (Schwein.: Fr.) Pouzar

* ***cinereolilacina*** (***Biscogniauxia***) (J. H. Miller) Pouzar ≡ ***Hypoxylon cinereolilacinum*** J. H. Miller ≡ ***Numulariola cinereolilacina*** (J. H. Miller) P. Martin

cinereum (***Hypoxylon***) Ellis & Everh., N. Amer. Pyren., p. 647. 1892.

≡ * ***Jumillera cinerea*** (Ellis & Everh.) J. D. Rogers, Y.-M. Ju, & San

Martín, Mycotaxon 64: 43. 1997.
U.S.A.: Louisiana, near St. Martinsville, 28.III.1890, Langlois, A. B., Fl. Ludoviciana 2278, decorticated wood (NY, HOLOTYPE of ***Hypoxylon cinereum***).

Also see Rogers et al. (1997).

cinnabarina (***Nummularia***) Henn., Hedwigia 36: 227. 1897.
≡ * ***Hypoxylon cinnabarinum*** (Henn.) Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 99. 1996.

* ***citriformis*** (***Biscogniauxia***) (Whalley, Hammelev, & Taligoola) Van der Gucht & Whalley ≡ ***Hypoxylon citriforme*** Whalley, Hammelev, & Taligoola

* ***citriformis*** (***Biscogniauxia***) (Whalley, Hammelev, & Taligoola) Van der Gucht & Whalley *var.* ***macrospora*** Van der Gucht & Whalley

citrincola (***Nummularia***) Rehm, Leafl. Philipp. Bot. 8: 2961. 1916.
PHILIPPINES: Los Baños, 1.IV.1914, Baker, C. F. 3062, corticated wood of ***Citrus*** (S, HOLOTYPE of ***Nummularia citrincola***).

A coelomycetous fungus and probably a ***Botryodiplodia*** Sacc.

clypeus (***Nummularia***) (Schwein.) Cooke ≡ ***Sphaeria clypeus*** Schwein. ≡ ***Hypoxylon clypeus*** (Schwein.) M. A. Curtis ≡ ***Diatrype clypeus*** (Schwein.) Berk. = * ***Biscogniauxia mediterranea*** (De Not.) Kuntze

clypeus (***Nummularia***) (Schwein.) Cooke *var.* ***macrospora*** Theiss. = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers

comedens (***Nummularia***) (Ces.) Cooke, Grevillea 11: 126. 1883.
≡ ***Hypoxylon comedens*** Ces., Atti Acad. Sci. Fis. 8: 19. 1879.
≡ ***Numulariola comedens*** (Ces.) P. Martin, J. S. African Bot. 35: 318. 1969.
MALAYSIA: Borneo, Sarawak, Beccari, O. 218, decorticated wood (RO, HOLOTYPE of ***Hypoxylon comedens***).

The taxonomic position of this fungus is uncertain. See Laessøe et al. (1989) for a discussion.

commixta (***Nummularia***) Rehm, Hedwigia 47: 6. 1905.
BRAZIL: São Leopoldo, 1907, Theissen, F., wood, as ***Nummularia commixta*** by Rehm, H. (GZU-Petrak 1441).

The cited material is ***Camillea scriblita*** (Mont.) Laessøe, J. D. Rogers, & Whalley.

commixta (***Nummularia***) Rehm *var.* ***applanata*** Theiss., Ann. Mycol. 6: 350. 1908.
≡ ***Hypoxylon applanatum*** (Theiss.) J. H. Miller, Mycologia 32: 181. 1940.
= * ***Hypoxylon*** (***Camillea***) ***glycyrrhiza*** Berk. & M. A. Curtis *sensu* J. H. Miller. *Fide* Laessøe et al.(1989) and Miller (1961).

commixta (***Nummularia***) Rehm *var.* ***minor*** Rehm *apud* Theiss., Ann. Mycol. 7: 13. 1909.

Probably a ***Camillea*** Fr.

* ***communapertura*** (***Biscogniauxia***) Y.-M. Ju & J. D. Rogers

constricta (***Nummularia***) (Fr.: Fr.) Sacc., Syll. Fung. I, p. 401. 1882.

≡ ***Sphaeria constricta*** Fr.: Fr., Elench. Fung. II, p. 70. 1828.
A *nomen confusum*. See Ju and Rogers (1996).

cookeana (***Nummularia***) (Sacc.) Rehm, Leafl. Philipp. Bot. 6: 2273. 1914.
≡ ***Nummularia suborbicularis*** (Welw. & Curr.) Sacc. *var.* ***cookeana*** Sacc. See this entry in this list for notes.

crassipes (***Nummularia***) Torrend, *ined.*
BRAZIL: 26.X.1957, Torrend, C. 8681, wood, as ***Nummularia crassipes*** (WSP 48720).
A ***Camarops*** P. Karst.

cyclisca (***Nummularia***) (Mont.) Cooke, Grevillea 11: 126. 1883.
≡ ***Hypoxylon cycliscum*** Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 122. 1855.
≡ ***Numulariola cyclisca*** (Mont.) P. Martin, J. S. African Bot. 35: 290. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.
≡ * ***Camillea cyclisca*** (Mont.) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 128. 1989.

cyclops (***Numulariola***) (Mont.) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.
≡ ***Hypoxylon cyclops*** Mont., Ann. Sci. Nat. Bot., sér. II, 13: 353. 1840.
≡ * ***Camillea cyclops*** (Mont.) Berk. & M. A. Curtis, J. Acad. Nat. Sci. Philadelphia, ser. II, 2: 285. 1853. *Fide* Laessøe et al. (1989).

* ***dennisii*** (***Biscogniauxia***) (Pouzar) Pouzar ≡ ***Nummularia dennisii*** Pouzar

diatrypeoides (***Nummularia***) Rehm, Ann. Mycol. 5: 527. 1907. Figs. 32 & 33
≡ ***Numulariola diatrypeoides*** (Rehm) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.
BRAZIL: Rio Grande do Sul, 1906, Rick, J., twigs (S, HOLOTYPE of ***Nummularia diatrypeoides***); São Leopoldo, 1907, Theissen, F., Rick's Austro.-Amer. 314, twigs, as ***Nummularia diatrypeoides*** (GZU-Petrak 1443); Rio Grande do Sul, São Leopoldo, 1907, Theissen, F., Dec. Fung. Bras. 214, twigs, as ***Nummularia diatrypeoides*** (GZU-Petrak 1479); São Leopoldo, 1908, Rick, J., Fung. Austro.-Amer. 223, twigs, as ***Nummularia diatrypeoides*** (GZU-Petrak 1442); Rick, J., *ex* Lloyd herb., twigs, as ***Nummularia diatrypeoides*** (GZU-Petrak 2122).

The taxonomic position of this fungus is uncertain. Stromata are discoid, with sloped margins, subepidermally erumpent, and probably with bipartite stromata, 1.5–3 mm diam x 1 mm thick, black externally and internally, carbonaceous. Perithecia are ovoid, 0.3–0.4 mm diam x 0.8 mm high. Ostioles are lower than the stromatal surface, and have punctate openings. Asci are possibly bitunicate, clavate, short-stipitate, with eight ascospores arranged in a partially biseriate manner, with an inamyloid apical crown. Ascospores are dark brown, unicellular, ellipsoid, nearly equilateral, 42–55 x 23.5–32.5 μm, with a straight, spore-length germ slit and a hyaline sheath. Miller (1961) considered this fungus to be a typical ***Nummularia***.

discincola (***Nummularia***) (Schwein.: Fr.) Cooke, Grevillea 12: 6. 1883.
≡ ***Sphaeria discincola*** Schwein., Schriften Naturf. Ges. Leipzig 1: 34. 1822; Schwein.: Fr., Syst. Mycol. II, p. 368. 1823.
≡ ***Diatrype discincola*** (Schwein.: Fr.) M. A. Curtis, Geol. Nat. Hist. Surv.

North Carolina, pt. III, p. 141. 1867.
≡ ***Anthostoma discincolum*** (Schwein.: Fr.) Sacc., Syll. Fung. I, p. 296. 1882.
According to Eckblad and Granmo (1978), the type at UPS contains a sphaeropsidaceous fungus only.

discoidea (***Nummularia***) (Lév.) Berl. & Sacc. *apud* Sacc., Syll. Fung. IX, p. 570. 1891.
≡ ***Sphaeria discoidea*** Lév., Ann. Sci. Nat. Bot., sér. IV, 20: 295. 1863.
We were unable to locate the type at K or PC.

discreta (***Biscogniauxia***) (Schwein.) Kuntze ≡ ***Sphaeria discreta*** Schwein. ≡ ***Nummularia discreta*** (Schwein.) Tul. & C. Tul. ≡ ***Diatrype discreta*** (Schwein.) M. A. Curtis ≡ ***Hypoxylon discretum*** (Schwein.) Berk. ≡ ***Numulariola discreta*** (Schwein.) House = * ***Biscogniauxia marginata*** (Fr.: Fr.) Pouzar

* ***divergens*** (***Biscogniauxia***) (Theiss.) Whalley & Laessøe ≡ ***Nummularia divergens*** Theiss. ≡ ***Hypoxylon divergens*** (Theiss.) J. H. Miller *ex* Dennis ≡ ***Numulariola divergens*** (Theiss.) P. Martin

divergens (***Biscogniauxia***) (Theiss.) Whalley & Laessøe *var.* ***macrospora*** (J. H. Miller) Whalley & Laessøe ≡ ***Hypoxylon divergens*** (Theiss.) J. H. Miller *var.* ***macrospora*** J. H. Miller = * ***Biscogniauxia philippinensis*** (Ricker) Whalley & Laessøe

* ***doidgeae*** (***Biscogniauxia***) (J. H. Miller) Whalley & Laessøe ≡ ***Hypoxylon doidgeae*** J. H. Miller ≡ ***Numulariola doidgeae*** (J. H. Miller) P. Martin

dryophila (***Nummularia***) Tul. & C. Tul., Sel. Fung. Carp. II, p. 47. 1863.
≡ ***Biscogniauxia dryophila*** (Tul. & C. Tul.) Kuntze, Rev. Gen. Pl. II, p. 398. 1891.
≡ * ***Obolarina dryophila*** (Tul. & C. Tul.) Pouzar, Česká Mykol. 40: 7. 1986.

dura (***Nummularia***) Ferd. & Winge *apud* Raunk., Bot. Tidsskr. 29: 15. 1908.
≡ * ***Camillea tinctor*** (Berk.) Laessøe, J. D. Rogers, & Whalley. *Fide* Laessøe et al. (1989).

emergens (***Nummularia***) C. G. Lloyd, Mycol. Writings 7: 1353. 1925.
= * ***Camillea obularia*** (Fr.) Laessøe, J. D. Rogers, & Lodge. *Fide* Laessøe et al. (1989) and Rogers et al. (1991).

excavata (***Nummularia***) (Schwein.) Ellis & Everh. ≡ ***Sphaeria excavata*** Schwein. = * ***Biscogniauxia marginata*** (Fr.: Fr.) Pouzar

exutans (***Biscogniauxia***) (Cooke) Barr ≡ ***Diatrype exutans*** Cooke ≡ ***Nummularia exutans*** (Cooke) Cooke ≡ ***Hypoxylon exutans*** (Cooke) Cooke ≡ ***Anthostoma exutans*** (Cooke) Sacc. ≡ ***Numulariola exutans*** (Cooke) P. Martin = ? ***Biscogniauxia fuscella*** (Rehm) San Martín & J. D. Rogers

flosculosa (***Nummularia***) Starb., Bih. Kongl. Svenska Vetensk.- Akad. Handl. 27, 3: 11. 1901.
≡ ***Hypoxylon flosculosum*** (Starb.) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 105. 1961.
≡ ***Numulariola flosculosa*** (Starb.) P. Martin, J. S. African Bot. 35: 290.

1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 76. 1976.
≡ * ***Camillea flosculosa*** (Starb.) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 131. 1989.

fossulata (***Nummularia***) (Mont.) Cooke, Grevillea 11: 127. 1883.
≡ ***Hypoxylon fossulatum*** Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 123. 1855.
≡ ***Numulariola fossulata*** (Mont.) P. Martin, J. S. African Bot. 42: 77. 1976.
≡ * ***Camillea fossulata*** (Mont.) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 131. 1989.

fragillima (***Nummularia***) Rehm, Leafl. Philipp. Bot. 8: 2959. 1916.
≡ ***Hypoxylon fragillimum*** (Rehm) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 120. 1961.
PHILIPPINES: Mt. Maquiling, 25.IV.1916, Baker, C. F. 3187, ***Calamus*** palm (S, HOLOTYPE of ***Nummularia fragillima***); Laguna, near Los Baños, Mt. Maquiling, IV.1914, Baker, C. F., Fungi Malayana 169, ***Calamus*** palm (GZU-Petrak; S; BPI [2 pks.], ISOTYPES of ***Nummularia fragillima***).

We are uncertain about the taxonomic position of this fungus. See Ju and Rogers (1996).

frustulosa (***Nummularia***) (Berk. & M. A. Curtis) Sacc., Syll. Fung. I, p. 398. 1882.
≡ ***Hypoxylon frustulosum*** Berk. & M. A. Curtis *apud* Berk., J. Linn. Soc., Bot. 10: 383. 1869.
≡ * ***Xylaria frustulosa*** (Berk. & M. A. Curtis) Cooke, Grevillea 12: 5. 1883.
CUBA: Wright, C. 497, wood (FH, ISOTYPE of ***Hypoxylon frustulosum***).

fuckelia (***Nummularia***) Theiss., Ann. Mycol. 6: 350. 1908.
BRAZIL: São Leopoldo, 1909, Theissen, F., Rick's Fung. Aust.-Amer. 313, wood, as ***Nummularia fuckelia*** (GZU-Petrak 1449).

The cited specimen is young material of ***Camillea heterostoma*** (Mont.) Laessøe, J. D. Rogers, & Whalley. It seems likely that ***N. fuckelia***, in fact, represents this fungus.

Miller (1961) mentioned that this fungus is like ***Hypoxylon scriblita*** Mont. [≡ ***Camillea scriblita*** (Mont.) Laessøe, J. D. Rogers, & Whalley] in having ostioles with annulate rims at the center of shallow depressions, but unlike the latter in having smaller ascospores, 12–15 x 5–6.5 µm.

* ***fuscella*** (***Biscogniauxia***) (Rehm) San Martín & J. D. Rogers ≡ ***Nummularia fuscella*** Rehm ≡ ***Hypoxylon fuscellum*** (Rehm) J. H. Miller ≡ ***Numulariola fuscella*** (Rehm) P. Martin

fuscodisca (***Nummularia***) Pat. = * ***Biscogniauxia pithodes*** (Berk. & Broome) Whalley & Laessøe

gigas (***Nummularia***) W. Phillips & Plowr., Grevillea 8: 106. 1880.
≡ ***Camarops tubulina*** (Albertini & Schwein.: Fr.) Shear *var.* ***gigas*** (W. Phillips & Plowr.) Shear, Mycologia 30: 586. 1938.

Nannfeldt (1972) mentioned this fungus having a germ pore on one end of the ascospores. Thus, it does not belong to the Xylariaceae. He stated that "the spore characters point towards the heterogeneous assemblage still known as ***Anthostoma***."

gigaspora (***Nummularia***) Pat., *ined.*

NEW CALEDONIA: wood, as ***Nummularia gigaspora*** Pat., *ined.* (FH).

= * ***Kretzschmaria deusta*** (Hoffm.: Fr.) P. Martin

glycyrrhiza (***Nummularia***) (Berk. & M. A. Curtis) Sacc., Syll. Fung. I, p. 401. 1882.

≡ ***Hypoxylon glycyrrhiza*** Berk. & M. A. Curtis *apud* Berk., J. Acad. Nat. Sci. Philadelphia, ser. II, 2: 285. 1853.

≡ ***Numulariola glycyrrhiza*** (Berk. & M. A. Curtis) P. Martin, J. S. African Bot. 35: 291. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

SURINAM: wood, as ***Sphaeria nummularia*** (PH, ISOTYPE of ***Hypoxylon glycyrrhiza***); this mounted specimen is enclosed in the envelope bearing the name "***Sphaeria nummularia*** Dec. *var.* ***striata***, Syn. # 1219."

We could not find ascospores in the PH material. Laessøe et al. (1989) mentioned that there are "a few almost colourless to dilute brown ascospores 12.4–16.2 x 5.2–6.2 μm" in the holotype. It indicates that Miller's interpretation of ***Hypoxylon glycyrrhiza*** does not correspond with type material. ***Hypoxylon glycyrrhiza*** *sensu* Miller (1961) is a ***Camillea*** Fr. taxon (Laessøe et al., 1989).

gracilenta (***Nummularia***) Syd. & P. Syd., Ann. Mycol. 8: 37. 1910.

PHILIPPINES: Dumaguete, (Cuernos Mts.), prov. Negros Orient., III.1908, Elmer, A. D. E. 9684, wood (WSP 29016, TYPE of ***Nummularia gracilenta***).

= * ***Whalleya microplaca*** (Berk. & M. A. Curtis) J. D. Rogers, Y.-M. Ju, & San Martín

Also see Rogers et al. (1997).

* ***grenadensis*** (***Biscogniauxia***) (J. H. Miller) Whalley & Laessøe ≡ ***Hypoxylon grenadense*** J. H. Miller ≡ ***Numulariola grenadensis*** (J. H. Miller) P. Martin

grenadensis (***Biscogniauxia***) (J. H. Miller) Whalley & Laessøe *var.* ***macrospora*** (J. H. Miller) Whalley & Laessøe ≡ ***Hypoxylon grenadense*** J. H. Miller *var.* ***macrospora*** J. H. Miller = * ***Biscogniauxia grenadensis*** (J. H. Miller) Whalley & Laessøe

grisea (***Nummularia***) Rick, Ann. Mycol. 7: 13. 1909.

BRAZIL: Nova Petropolis, 1923, Rick, J. 226, decorticated wood (GAM 2036, LECTOTYPE [selected by Rogers et al. (1997)] & 2038, SYNTYPE of ***Nummularia grisea***).

= * ***Jumillera cinerea*** (Ellis & Everh.) J. D. Rogers, Y.-M. Ju, & San Martín

Also see Rogers et al. (1997).

guaranitica (***Nummularia***) Speg., An. Soc. Cient. Argent. 18: 268. 1884.

≡ ***Numulariola guaranitica*** (Speg.) P. Martin, J. S. African Bot. 35: 291. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

PARAGUAY: Guarapi, VII.1881, Balansa, B. 2769, wood (GZU-Petrak; K, ISOTYPES of ***Nummularia guaranitica***).

= * ***Camillea signata*** (S. C. Jong & C. R. Benjamin) Laessøe, J. D. Rogers, & Whalley

Miller (1961) considered this fungus a good ***Nummularia***. Laessøe et al. (1989) synonymized these names with ***Camillea broomeiana*** (Berk. & M. A. Curtis) Laessøe, J. D. Rogers, & Whalley which was later treated as a synonym of ***C. obularia*** (Fr.) Laessøe, J. D. Rogers, & Lodge by Rogers et al. (1991). We could not locate the type at LPS.

guaranitica (***Nummularia***) Speg. *var.* ***irregularis*** Rehm, Hedwigia 40: 141. 1901.

We have not seen material of this fungus.

helvetica (***Numulariola***) (Nitschke) P. Martin, J. S. African Bot. 35: 291. 1969; [*nom. inval.*, ICBN Art. 33.2].

≡ ***Phaeosperma helvetica*** Nitschke *apud* Fuckel, Jahrb. Nassauischen Vereins Naturk 23–24: 224. 1869–70.

≡ ***Fuckelia helvetica*** (Nitschke) Fuckel, Symb. Mycol. Nachtr. 2: 40. 1873.

= * ***Camarops microspora*** (P. Karst.) Shear. *Fide* Nannfeldt (1972).

hemisphaerica (***Numulariola***) (J. H. Miller) P. Martin, J. S. African Bot. 35: 291. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

≡ ***Hypoxylon hemisphaericum*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 115. 1961.

= * ***Camillea gigaspora*** (Massee) Laessøe, J. D. Rogers, & Whalley. *Fide* Laessøe et al. (1989).

heterostoma (***Nummularia***) (Mont.) Cooke, Grevillea 11: 126. 1883.

≡ ***Sphaeria heterostoma*** Mont., Ann. Sci. Nat. Bot., sér. II, 13: 358. 1840.

≡ ***Hypoxylon heterostomum*** (Mont.) Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 121. 1855.

≡ ***Numulariola heterostoma*** (Mont.) P. Martin, J. S. African Bot. 35: 290. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

≡ * ***Camillea heterostoma*** (Mont.) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 134. 1989.

heterostoma (***Numulariola***) (Mont.) P. Martin *var.* ***macrospora*** (J. H. Miller) P. Martin, J. S. African Bot. 35: 290. 1969; [*nom. inval.*, ICBN Art. 33.2].

≡ ***Hypoxylon heterostomum*** (Mont.) Mont. *var.* ***macrospora*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 103. 1961.

≡ * ***Camillea heterostoma*** (Mont.) Laessøe, J. D. Rogers, & Whalley *var.* ***macrospora*** (J. H. Miller) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 134. 1989.

hyalospora (***Nummularia***) Pat., Bull. Soc. Mycol. France 14: 56. 1898.

≡ * ***Camillea hyalospora*** (Pat.) J. D. Rogers, Laessøe, & Lodge, Mycologia 83: 224. 1991.

hypophlaea (***Nummularia***) (Berk. & Ravenel) Cooke, Grevillea 12: 7. 1883.

≡ ***Diatrype hypophlaea*** Berk. & Ravenel *apud* Berk., Grevillea 4: 95. 1876.

≡ ***Anthostoma hypophlaeum*** (Berk. & Ravenel) Sacc., Syll. Fung. I, p. 306. 1882.
≡ ***Hypoxylon hypophlaeum*** (Berk. & Ravenel) S. Teng, Sinensia 4: 403. 1934.
≡ ***Numulariola hypophlaea*** (Berk. & Ravenel) P. Martin, J. S. African Bot. 35: 292. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.
≡ * ***Jumillera hypophlaea*** (Berk. & Ravenel) J. D. Rogers, Y.-M. Ju, & San Martín, Mycotaxon 64: 45. 1997.
U.S.A.: South Carolina, Santee Canal, Ravenel, H. W., dead limbs of ***Magnolia glauca***, as ***Sphaeria hypophloea*** Berk. & Ravenel, *ined.* (K 36395, HOLOTYPE of ***Diatrype hypophlaea***); 1855, Ravenel, H. W., Fung. Carol. Fasc. IV, no. 38, corticated wood of ***Magnolia glauca*** (BPI 589617; NY, TYPES? of ***Diatrype hypophlaea***); New Jersey, Newfield, XI.1883, Ellis, J. B., dead trunks of ***Magnolia glauca***, as ***Nummularia hypophloea*** (BPI 589616); New Jersey, Newfield, IV.1894, Ellis, J. B., Fungi Columbiani 429, dead ***Magnolia glauca***, as ***Nummularia hypophloea*** (WSP 4783).

Also see Rogers et al. (1997).

hypoxyloides (***Numulariola***) (P. Karst.) P. Martin, J. S. African Bot. 35: 290. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.
≡ ***Camarops hypoxyloides*** P. Karst., Mycol. Fenn. II, p. 53. 1873.
= * ***Camarops polysperma*** (Mont.) J. H. Miller, Trans. Brit. Mycol. Soc. 15: 151. 1930. *Fide* Nannfeldt (1972).

ianthina (***Nummularia***) (Cooke) C. G. Lloyd, Mycol. Writings 7: 1312. 1924.
≡ ***Hypoxylon ianthinum*** Cooke, Grevillea 11: 132. 1883.
= * ***Hypoxylon fuscopurpureum*** (Schwein.: Fr.) M. A. Curtis. *Fide* Ju and Rogers (1996).

intermedium (***Hypoxylon***) Speg. *non* (Schwein.: Fr.) Ju & J. D. Rogers = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

* ***kalchbrenneri*** (***Biscogniauxia***) (Sacc.) Y.-M. Ju & J. D. Rogers ≡ ***Hypoxylon kalchbrenneri*** Sacc. ≡ ***Nummularia kalchbrenneri*** (Sacc.) J. H. Miller ≡ ***Numulariola kalchbrenneri*** (Sacc.) P. Martin

labellum (***Numulariola***) (Mont.) P. Martin, J. S. African Bot. 35: 289. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976; as "***labella***."
≡ * ***Camillea labellum*** Mont., Ann. Sci. Nat. Bot. sér. IV, 3: 113. 1855.

lamprostoma (***Nummularia***) Syd. & P. Syd., Ann. Mycol. 18: 99. 1920.
= * ***Whalleya microplaca*** (Berk. & M. A. Curtis) J. D. Rogers, Y.-M. Ju, & San Martín

Also see Rogers et al. (1997). Miller (1961) treated ***N. lamprostoma*** as a synonym of ***Hypoxylon microplacum***.

lataniaecola (***Nummularia***) Rehm & Bref. = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

lateritia (***Nummularia***) Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 45: 144. 1893.
≡ ***Kommamyce lateritia*** (Ellis & Everh.) Nieuwland, Amer. Midl. Naturalist 4: 373. 1916.

= * ***Hypoxylon cercidicolum*** (Berk. & M. A. Curtis *ex* Peck) Y.-M. Ju & J. D. Rogers. *Fide* Ju and Rogers (1996).

laurus (***Nummularia***) Morg., *ined.*

≡ * ***Hypoxylon laurus*** J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 66. 1961.

lepida (***Nummularia***) Syd. & P. Syd. ≡ ***Hypoxylon lepidum*** (Syd. & P. Syd.) Van der Bijl = ? ***Biscogniauxia kalchbrenneri*** (Sacc.) Y.-M. Ju & J. D. Rogers

leprieurii (***Numulariola***) (Mont.) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

≡ ***Hypoxylon leprieurii*** (Mont.) Mont., Ann. Sci. Nat. Bot., sér. II, 13: 352. 1840.

≡ * ***Camillea leprieurii*** Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 122. 1855.

leucosticta (***Nummularia***) Ellis & Morg., *ined.* * = ***Biscogniauxia albosticta*** (Ellis & Morg.) Y.-M. Ju & J. D. Rogers

lianae (***Nummularia***) Rehm = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers

linearis (***Numulariola***) P. Martin, J. S. African Bot. 35: 292. 1969; [*nom. inval.*, ICBN Arts. 36.1 & 37.1]; J. S. African Bot. 42: 83. 1976.

This fungus was said to have a dull yellow pigment in the stromatal interior (Martin, 1969). We have not seen material of this fungus.

lucida (***Nummularia***) Torrend, *ined.*

BRAZIL: 23.XI.1957, Torrend, C. 8916, wood, as ***Nummularia lucida*** (WSP 48722).

Two species of ***Camillea*** were found in the packet.

lutea (***Nummularia***) (Albertini & Schwein.: Fr.) Nitschke, Pyren. Germ., p. 59. 1867.

≡ ***Sphaeria lutea*** Albertini & Schwein., Consp. Fung. Lusat., p. 10. 1805; Albertini & Schwein.: Fr., Syst. Mycol. II, p. 347. 1823.

≡ ***Hypoxylon luteum*** (Albertini & Schwein.: Fr.) Fr., Summa Veg. Scand. II, p. 383. 1849.

≡ ***Bolinia lutea*** (Albertini & Schwein.: Fr.) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 138. 1961.

≡ ***Numulariola lutea*** (Albertini & Schwein.: Fr.) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

≡ * ***Camarops lutea*** (Albertini & Schwein.: Fr.) Nannf., Svensk Bot. Tidskr. 66: 363. 1972.

luteoviridis (***Nummularia***) Kirschst., Verh. Bot. Vereins Prov. Brandenburg 48: 58. 1906.

Probably a ***Camarops*** P. Karst.

luzonensis (***Nummularia***) Yates, *ined.*

PHILIPPINES: Luzon, Province of Tayabas, Mt. Cadig, XII.1916, Yates, H. S. 25760, bamboo culms, as ***Nummularia luzonensis*** Yates, *n. sp.* (GZU-Petrak 1459; K 36393).

Possibly a loculoascomycete. Miller (1961) mentioned that this fungus is close to ***Hypoxylon nummularioides*** Rehm, but has a hyaline sheath surrounding the ascospore. Despite the similarities in the stromatal morphology and ascospore shape, ***Hypoxylon nummularioides*** and ***N. luzonensis*** have several major differences and do not appear closely related. ***Nummularia luzonensis*** differs from ***H. nummularioides*** in lacking an ascospore germ slit, in having a thickening on the ascus tip where an apical ring is apparently lacking, and in having a thick hyaline sheath surrounding the ascospore. This fungus should be excluded from the Xylariaceae as suspected by Laessøe and Spooner (1994). It should be noted that most of the ascospores in the material of ***N. luzonensis*** have become distorted and changed in shape.

macrocenangia (***Nummularia***) (Ces.) Cooke, Grevillea 12: 7. 1883.

≡ ***Hypoxylon macrocenangium*** Ces., Atti Accad. Sci. Fis. 8: 19. 1879.

≡ * ***Camarops macrocenangium*** (Ces.) Nannf., Svensk Bot. Tidskr. 66: 364. 1972.

MALAYSIA: Borneo, Beccari, O. 196, wood (RO, HOLOTYPE of ***Hypoxylon macrocenangium***).

macromphala (***Numulariola***) (Mont.) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 77. 1976.

≡ ***Hypoxylon macromphalum*** Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 122. 1855.

≡ ***Camillea macromphala*** (Mont.) Cooke, Grevillea 12: 3. 1883.

= * ***Camillea cyclops*** (Mont.) Berk. & M. A. Curtis. *Fide* Laessøe et al. (1989).

macrospora (***Nummularia***) Pat., Bull. Soc. Mycol. France 3: 175. 1887.

NEW CALEDONIA: no. 735, wood (FH [3 pks.], HOLOTYPE of ***Nummularia macrospora***); Mont Mou, 7.1909, Le Rat 229, wood, as ***Nummularia macrospora*** Pat. (FH).

It is the same as ***Hypoxylon sandvicense*** Reichart (see Ju and Rogers, 1996). This name may represent a tropical form of ***Kretzschmaria deusta*** (Hoffm.: Fr.) P. Martin or a distinct taxon. Typical collections of ***K. deusta*** found in northern temperate regions have shorter ascospores that have a much less than spore-length germ slit.

macula (***Biscogniauxia***) (Schwein.) Van der Gucht ≡ ***Sphaeria macula*** Schwein. *non* Tode ≡ ***Nummularia macula*** (Schwein.) Cooke ≡ ***Hypoxylon maculum*** (Schwein.) J. H. Miller ≡ ***Numulariola macula*** (Schwein.) P. Martin ≡ * ***Biscogniauxia schweinitzii*** Y.-M. Ju & J. D. Rogers

maculata (***Nummularia***) Theiss., Ann. Mycol. 6: 348. 1908.

≡ ***Hypoxylon maculatum*** (Theiss.) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 128. 1961.

≡ ***Numulariola maculata*** (Theiss.) P. Martin, J. S. African Bot. 35: 293. 1969; [*nom. inval.*, ICBN Art. 37.1]; J. S. African Bot. 42: 78. 1976.

≡ * ***Whalleya maculata*** (Theiss.) J. D. Rogers, Y.-M. Ju, & San Martín, Mycotaxon 64: 49. 1997.

BRAZIL: Rio Grande do Sul, São Leopoldo, Theissen, F., Dec. Fung. Brasil. 116 [= Rehm's Ascomyc. 1913], corticated branches (BPI 589563, SYNTYPE of ***Nummularia maculata***); São Leopoldo, 1907, Theissen, F., Rick's Fung. Austro-Amer. 308, corticated branches (BPI 590089, SYNTYPE of ***Nummularia maculata***); Rick, J., corticated wood (GAM 2933, TYPE of ***Nummularia maculata***); Theissen, F., wood, as ***Nummularia clypeus*** *var.* ***macrospora*** (FH).

Also see Rogers et al. (1997).

* ***marginata*** (***Biscogniauxia***) (Fr.: Fr.) Pouzar ≡ ***Sphaeria marginata*** Fr.: Fr. *non* Sowerby, *nec* Schwein. ≡ ***Nummulariella marginata*** (Fr.: Fr.) Eckblad & Granmo

maritima (***Biscogniauxia***) Lar. N. Vasilyeva ≡ * ***Biscogniauxia atropunctata*** (Schwein.: Fr.) Pouzar *var.* ***maritima*** (Lar. N. Vasilyeva) Y.-M. Ju & J. D. Rogers

mauritanica (***Nummularia***) Berk. & Cooke = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

maxima (***Nummularia***) (Massee) Theiss. & Syd. ≡ ***Auerswaldia maxima*** Massee = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

* ***mediterranea*** (***Biscogniauxia***) (De Not.) Kuntze ≡ ***Sphaeria mediterranea*** De Not. ≡ ***Hypoxylon mediterraneum*** (De Not.) Ces. & De Not. ≡ ***Nummularia mediterranea*** (De Not.) Sacc. ≡ ***Numulariola mediterranea*** (De Not.) P. Martin

* ***mediterranea*** (***Biscogniauxia***) (De Not.) Kuntze *var.* ***macrospora*** (J. H. Miller) Y.-M. Ju & J. D. Rogers ≡ ***Hypoxylon mediterraneum*** (De Not.) Ces. & De Not. *var.* ***macrospora*** J. H. Miller

* ***mediterranea*** (***Biscogniauxia***) (De Not.) Kuntze *var.* ***microspora*** (J. H. Miller) Y.-M. Ju & J. D. Rogers ≡ ***Hypoxylon mediterraneum*** (De Not.) Ces. & De Not. *var.* ***microspora*** J. H. Miller

melanaspis (***Nummularia***) (Mont.) Cooke, Grevillea 11: 127. 1883.

≡ ***Sphaeria melanaspis*** Mont., Ann. Sci. Nat. Bot., sér. II, 13: 357. 1840.

≡ ***Hypoxylon melanaspis*** (Mont.) Mont., Syll. Gen. Sp. Crypt., p. 215. 1856.

≡ ***Numulariola melanaspis*** (Mont.) P. Martin, J. S. African Bot. 35: 290. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

= * ***Camillea leprieurii*** (Mont.) Mont., applanate form. *Fide* Laessøe et al. (1989).

memorabilis (***Nummularia***) Rehm, Leafl. Philipp. Bot. 8: 2960. 1916.

PHILIPPINES: summit of Mt. Makiling, 1.VI.1914, Baker, C. F. 3432, wood (S, HOLOTYPE of ***Nummularia memorabilis***).

A ***Nemania*** S. F. Gray with discoid to pulvinate stromata.

merrillii (***Nummularia***) Bres. ≡ ***Numulariola merrillii*** (Bres.) P. Martin = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

microplaca (***Nummularia***) (Berk. & M. A. Curtis) Cooke, Grevillea 12: 8. 1883.

≡ ***Diatrype microplaca*** Berk. & M. A. Curtis, J. Linn. Soc., Bot. 10: 386. 1869.

≡ ***Anthostoma microplacum*** (Berk. & M. A. Curtis) Sacc., Syll. Fung. I, p. 298. 1882.

≡ ***Hypoxylon microplacum*** (Berk. & M. A. Curtis) J. H. Miller, Mycologia 33: 77. 1941.

≡ ***Numulariola microplaca*** (Berk. & M. A. Curtis) P. Martin, J. S. African Bot. 35: 299. 1969.

≡ *** Whalleya microplaca*** (Berk. & M. A. Curtis) J. D. Rogers, Y.-M. Ju, & San Martín, Mycotaxon 64: 48. 1997.

U.S.A.: Virginia, Dead Run, 30.V.1899, Shear, C. L., Ellis & Everhart's Fungi Columbiani (continued by C. L. Shear) 1419, dead ***Sassafras officinale***, as ***Nummularia microplaca*** (WSP 4785).

Also see Rogers et al. (1997).

microspora (***Numulariola***) (P. Karst.) P. Martin, J. S. African Bot. 35: 291. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

≡ ***Phaeosperma microsporum*** P. Karst., Mycol. Fenn. II, p. 53. 1873.

≡ *** Camarops microspora*** (P. Karst.) Shear, Mycologia 30: 588. 1939. *Fide* Nannfeldt (1972).

microsticta (***Nummularia***) (Mont.) Cooke, Grevillea 11: 127. 1883.

≡ ***Sphaeria microsticta*** Mont., Ann. Sci. Nat. Bot., sér. II, 13: 358. 1840.

≡ ***Hypoxylon microstictum*** (Mont.) Mont., Syll. Gen. Sp. Crypt., p. 216. 1856.

= *** Camillea leprieurii*** (Mont.) Mont. *Fide* Laessøe et al. (1989).

minutula (***Nummularia***) Penz. & Sacc., Malpighia 11: 495. 1897.

≡ ***Hypoxylon minutulum*** (Penz. & Sacc.) J. M. Miller *ex* S. Teng, Contr. to Our Knowledge of the Higher Fungi of China, p. 125. 1939.

INDONESIA: Java, Tjibodas, 3.III.1897, no. 404, culms of ***Bambusa*** (PAD, HOLOTYPE of ***Nummularia minutula***).

A ***Nemania*** S. F. Gray. See Ju and Rogers (1994).

moelleriana (***Nummularia***) Henn., Hedwigia 36: 228. 1897.

≡ *** Hypoxylon moellerianum*** (Henn.) Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 149. 1996.

morganii (***Numulariola***) P. Martin, J. S. African Bot. 35: 292. 1969; [*nom. inval.*, ICBN Arts. 36.1 & 37.1]; J. S. African Bot. 42: 83. 1976; as "***morgani*** J. H. Miller *ex* P. Martin."

Martin (1969) mentioned this fungus as having a dull yellow pigment in the stromatal interior. We have not seen material of this fungus.

moselei (***Nummularia***) (Berk.) Cooke, Grevillea 12: 7. 1883.

≡ ***Hypoxylon moselei*** Berk., J. Linn. Soc., Bot. 14: 350. 1875.

BAHIA: Challenger, wood (K, HOLOTYPE of ***Hypoxylon moselei***).

A ***Camillea*** Fr.

*** mucigera*** (***Biscogniauxia***) Van der Gucht

mucronata (***Numulariola***) (Mont.) P. Martin, J. S. African Bot. 35: 287. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

≡ *** Camillea mucronata*** Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 112. 1855. *Fide* Laessøe et al. (1989).

*** nothofagi*** (***Biscogniauxia***) Whalley, Laessøe, & Kile

*** nummularia*** (***Biscogniauxia***) (Bull.: Fr.) Kuntze ≡ ***Hypoxylon nummularium*** Bull.: Fr. ≡ ***Sphaeria nummularia*** (Bull.: Fr.) DC. & Lam. ≡ ***Nummularia nummularia*** (Bull.: Fr.) J. Schröt. ≡ ***Numulariola nummularia*** (Bull.: Fr.) House

nummularia (***Biscogniauxia***) (Bull.: Fr.) Kuntze *var.* ***exutans*** (Cooke) Van der Gucht ≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***exutans*** (Cooke) J. H. Miller = ? ***Biscogniauxia fuscella*** (Rehm) San Martín & J. D. Rogers

nummularia (***Biscogniauxia***) (Bull.: Fr.) Kuntze *var.* ***merrillii*** (Bres.) Van der Gucht ≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***merrillii*** (Bres.) J. H. Miller = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

nummularia (***Biscogniauxia***) (Bull.: Fr.) Kuntze *var.* ***pseudopachyloma*** (Speg.) Whalley ≡ ***Hypoxylon nummularium*** Bull.: Fr. *var.* ***pseudopachyloma*** (Speg.) J. H. Miller = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

nummularium (***Hypoxylon***) Bull.: Fr. *var.* ***australe*** (Cooke) J. H. Miller = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers

nummularium (***Hypoxylon***) Bull.: Fr. *var.* ***macrosporum*** Gilman & Tiffany, Iowa St. Coll. J. Sci. 26: 470. 1952.

We have not examined material of this fungus.

nummularium (***Hypoxylon***) Bull.: Fr. *var.* ***rumpens*** (Cooke) J. H. Miller ≡ * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers

nummularium (***Hypoxylon***) Bull.: Fr. *var.* ***theissenii*** (Syd. & P. Syd.) J. H. Miller ≡ * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***theissenii*** (Syd. & P. Syd.) Y.-M. Ju & J. D. Rogers

obscura (***Numulariola***) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Arts. 36.1 & 37.1].

We have not seen material of this name.

obularia (***Nummularia***) (Fr.) Sacc., Syll. Fung. I, p. 400. 1882.

≡ ***Hypoxylon obularium*** Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 130. 1851.

≡ * ***Camillea obularia*** (Fr.) Laessøe, J. D. Rogers, & Lodge, Mycologia 83: 224. 1991.

oospora (***Nummularia***) Vouaux, Bull. Soc. Mycol. France 26: 155. 1910.

We have not seen material of this fungus.

ovata (***Nummularia***) Torrend, *ined.*

BRAZIL: Itaicy, 23.XI.1957, Torrend, C. 8917, wood, as ***Nummularia ovata*** Torrend, *ined.* (WSP 48723).

This is ***Whalleya maculata*** (Theiss.) J. D. Rogers, Y.-M. Ju, & San Martín (Rogers et al., 1997).

pachyloma (***Nummularia***) (Lév.) Cooke ≡ ***Sphaeria pachyloma*** Lév. ≡ ***Hypoxylon pachyloma*** (Lév.) Mont. *ex* Speg. = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

papyracea (***Nummularia***) Rehm ≡ ***Hypoxylon papyraceum*** (Rehm) J. H. Miller = * ***Biscogniauxia uniapiculata*** (Penz. & Sacc.) Whalley & Laessøe

parvula (***Nummularia***) Torrend, *ined.*

BRAZIL: Salinas, 5.XII.1957, Torrend, C. 9748, wood, as ***Nummularia parvula*** (WSP 48724).

A ***Camillea*** Fr. species.

***patella* (*Nummularia*)** Syd. & P. Syd., Ann. Mycol. 19: 305. 1921.

Possibly the same as ***Hypoxylon fragillimum*** (Rehm) J. H. Miller. See Ju and Rogers (1996).

***petersii* (*Numulariola*)** (Berk. & M. A. Curtis) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

≡ ***Hypoxylon petersii*** Berk. & M. A. Curtis *apud* Berk., J. Linn. Soc., Bot. 10: 384. 1869.

≡ ***Peridoxylon petersii*** (Berk. & M. A. Curtis) Shear, Mycologia 15: 126. 1923.

≡ ***Bolinia petersii*** C. G. Lloyd, Mycol. Writings 7: 1283. 1924.

≡ **** Camarops petersii*** (Berk. & M. A. Curtis) Nannf., Svensk Bot. Tidskr. 66: 366. 1972.

peziziformis* (*Nummularia*)** C. G. Lloyd = * Biscogniauxia marginata*** (Fr.: Fr.) Pouzar

***pezizoidea* (*Nummularia*)** Henn., Hedwigia 43: 260. 1904.

BRAZIL: Marary, Rio Juruá, IX.1900, Ule, E., wood (S, LECTOTYPE [selected by Ju and Rogers (1996)] of ***Nummularia pezizoidea***).

A ***Camillea*** Fr.

pezizoidea* (*Nummularia*)** Henn. *var.* ***fuliginea Theiss., Ann. Mycol. 7: 12. 1909.

Probably a ***Biscogniauxia***.

pezizoides* (*Biscogniauxia*)** (Ellis & Everh.) Kuntze ≡ ***Nummularia pezizoides Ellis & Everh. = **** Biscogniauxia repanda*** (Fr.: Fr.) Kuntze

***phyllireae* (*Biscogniauxia*)** (Mont.) Rappaz, Mycologia Helvetica 7: 162. 1995.

≡ ***Sphaeria phyllireae*** Mont. *apud* Durieu, Fl. Algér. Crypt. I, p. 458. 1846–49.

≡ ***Diatrype phyllireae*** (Mont.) Mont., Syll. Gen. Sp. Crypt., p. 217. 1856.

≡ ***Anthostoma phyllireae*** (Mont.) Sacc., Syll. Fung. I, p. 299. 1882.

≡ ***Nummularia phyllireae*** (Mont.) Cooke, Grevillea 12: 7. 1883.

We have not examined material of this fungus. According to Rappaz (1995), this fungus is close to ***Hypoxylon albostictum*** (Ellis & Morg.) J. H. Miller [≡ ***Biscogniauxia albosticta*** (Ellis & Morg.) Y.-M. Ju & J. D. Rogers].

*** *philippinensis* (*Biscogniauxia*)** (Ricker) Whalley & Laessøe ≡ ***Nummularia philippinensis*** Ricker ≡ ***Hypoxylon philippinense*** (Ricker) J. H. Miller ≡ ***Numulariola philippinensis*** (Ricker) P. Martin

*** *philippinensis* (*Biscogniauxia*)** (Ricker) Whalley & Laessøe *var.* ***microspora*** Y.-M. Ju & J. D. Rogers

*** *pithodes* (*Biscogniauxia*)** (Berk. & Broome) Whalley & Laessøe ≡ ***Diatrype pithodes*** Berk. & Broome ≡ ***Anthostoma pithodes*** (Berk. & Broome) Sacc. ≡ ***Nummularia pithodes*** (Berk. & Broome) Cooke ≡ ***Hypoxylon pithodes*** (Berk. & Broome) J. H. Miller ≡ ***Numulariola pithodes*** (Berk. & Broome) P. Martin

placenta (***Nummularia***) (Kalchbr.) Cooke ≡ ***Hypoxylon placenta*** Kalchbr. *non* (Link) Sacc. ≡ * ***Biscogniauxia kalchbrenneri*** (Sacc.) Y.-M. Ju & J. D. Rogers

placentiformis (***Nummularia***) (Berk. & M. A. Curtis) Sacc., Syll. Fung. I, p. 399. 1882.

≡ * ***Hypoxylon placentiforme*** Berk. & M. A. Curtis, J. Linn. Soc., Bot. 10: 383. 1869.

≡ ***Daldinia placentiformis*** (Berk. & M. A. Curtis) Theiss., Ann. Mycol. 7: 4. 1909.

≡ ***Hypodiscus placentiformis*** (Berk. & M. A. Curtis) Rick, Brotéria, sér. Bot., 25: 34. 1931.

See Ju and Rogers (1996).

* ***plana*** (***Biscogniauxia***) (Petch) Y.-M. Ju & J. D. Rogers ≡ ***Nummularia plana*** Petch

* ***plumbea*** (***Biscogniauxia***) Y.-M. Ju & J. D. Rogers

polysperma (***Biscogniauxia***) (Mont.) Lar. N. Vasilyeva, Mikologiya i Fitopatologiya 22: 394. 1988.

≡ ***Hypoxylon polyspermum*** Mont. *apud* Sagra, Hist. Phys. Pol. Nat. Cuba IX, p. 345. 1845.

≡ * ***Camarops polysperma*** (Mont.) J. H. Miller, Trans. Brit. Mycol. Soc. 15: 151. 1930.

≡ ***Numulariola polysperma*** (Mont.) P. Martin, J. S. African Bot. 35: 296. 1969.

porosa (***Nummularia***) Petch, Ann. Roy. Bot. Gard. (Peradeniya) 8: 165. 1924.

= * ***Theissenia pyrenocrata*** (Theiss.) Maubl. *Fide* Miller (1961).

porteri (***Hypoxylon***) Speg. = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

* ***pruni*** (***Biscogniauxia***) Granmo, Laessøe, & Scheuer, *nom. prov.*

pseudopachyloma (***Hypoxylon***) Speg. ≡ ***Numulariola pseudopachyloma*** (Speg.) P. Martin = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

punctatobrunnea (***Nummularia***) Theiss., Ann. Mycol. 6: 348. 1908.

≡ * ***Jumillera punctatobrunnea*** (Theiss.) J. D. Rogers, Y.-M. Ju, & San Martín, Mycotaxon 64: 47. 1997.

BRAZIL: Rio Grande do Sul, São Leopoldo, Theissen, F., Dec. Fung. Brasil. 82, corticated branches (BPI 589566, SYNTYPE of ***Nummularia punctatobrunnea***).

Also see Rogers et al. (1997).

punctatobrunnea (***Nummularia***) Theiss. *var.* ***variabilis*** Theiss., Ann. Mycol. 6: 348. 1908.

Type material was not located.

punctulata (***Nummularia***) (Berk. & Ravenel) Sacc., Syll. Fung. I, p. 399. 1882.

≡ ***Diatrype punctulata*** Berk. & Ravenel *apud* Berk., Grevillea 4: 94. 1876.

≡ ***Hypoxylon punctulatum*** (Berk. & Ravenel) Cooke, Grevillea 11: 138.

1883.

≡ ***Numulariola punctulata*** (Berk. & Ravenel) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

≡ * ***Camillea punctulata*** (Berk. & Ravenel) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 143. 1989.

punctulata (***Nummularia***) (Berk. & Ravenel) Sacc. *var.* ***indica*** Sacc. ≡ * ***Biscogniauxia uniapiculata*** (Penz. & Sacc.) Whalley & Laessøe *var.* ***indica*** (Sacc.) Y.-M. Ju & J. D. Rogers

pusilla (***Nummularia***) Sacc., Hedwigia 28: Tab. II, Fig. 3. 1889.

AUSTRALIA: Callington, Tepper, rotten wood, *ex* Lloyd herb. (GZU-Petrak 2138, TYPE of ***Nummularia pusilla***); Brisbane, Bailey, J. M. 631, rotten wood (K, HOLOTYPE of ***Hypoxylon ellipticum***).

The above-cited specimens are overmature and depauperate. The type material of ***Hypoxylon ellipticum*** is much like that of ***Nummularia pusilla*** except for the ascospores being more variable. They appear to represent a good ***Biscogniauxia*** taxon, but have an ascospore morphology more commonly found in ***Nemania*** S. F. Gray. Stromata are discoid to pulvinate, with steep margins, 1–10 mm long x 0.8–2 mm broad x 0.4 mm thick, black externally and internally, carbonaceous, with a plane surface. Perithecia obovoid, 0.1 mm diam x 0.2–0.3 mm high. Ostioles are lower than the stromatal surface and appear to be punctate on the stromatal surface; they are usually surrounded by a slightly raised rim. Asci were not observed. Ascospores are light brown, unicellular, fusoid to somewhat ellipsoid, nearly equilateral, (14–) 16–21 (–23) x 5.5–7 μm, with a straight germ slit much less than to less than spore-length.

pyrenocrata (***Numulariola***) (Theiss.) P. Martin, J. S. African Bot. 35: 291. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 78. 1976.

≡ ***Ustulina pyrenocrata*** Theiss., Ann. Mycol. 6: 347. 1908.

≡ * ***Theissenia pyrenocrata*** (Theiss.) Maubl., Bull. Mycol. Soc. France 30: 52. 1914.

* ***querna*** (***Biscogniauxia***) Pouzar

ramosum (***Hypoxylon***) Schwein. *ex* Cooke = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

regia (***Nummularia***) (De Not.) Sacc. ≡ ***Hypoxylon regium*** De Not. = * ***Biscogniauxia mediterranea*** (De Not.) Kuntze

regia (***Nummularia***) (De Not.) Sacc. *var.* ***mediterranea*** (De Not.) Traverso ≡ * ***Biscogniauxia mediterranea*** (De Not.) Kuntze

* ***repanda*** (***Biscogniauxia***) (Fr.: Fr.) Kuntze ≡ ***Sphaeria repanda*** Fr.: Fr. ≡ ***Hypoxylon repandum*** (Fr.: Fr.) Fr. ≡ ***Nummularia repanda*** (Fr.: Fr.) Nitschke ≡ ***Nummulariella repanda*** (Fr.: Fr.) Eckblad & Granmo

repanda (***Nummularia***) (Fr.: Fr.) Nitschke *var.* ***zonata*** Ellis & Everh. *apud* C. L. Smith, Bull. Iowa Univ. Lab. Nat. Hist. 2: 405. 1893.

= * ***Camillea labellum*** Mont. *Fide* Laessøe et al. (1989).

repandoides (***Nummularia***) (Fuckel) Sacc. ≡ ***Hypoxylon repandoides*** Fuckel = * ***Biscogniauxia mediterranea*** (De Not.) Kuntze

repandoides* (*Nummularia*)** (Fuckel) Sacc. *var.* ***singaporensis Sacc., Bull. Orto Bot. Regia Univ. Napoli 6: 10. 1918.
= * ***Camillea tinctor*** (Berk.) Laessøe, J. D. Rogers, & Whalley. *Fide* Laessøe et al. (1989).

* ***reticulospora* (*Biscogniauxia*)** Y.-M. Ju & J. D. Rogers

***reyesiana* (*Nummularia*)** Rehm, Leafl. Philipp. Bot. 8: 2960. 1916.
≡ ***Hypoxylon reyesianum*** (Rehm) J. H. Miller *ex* S. Teng, Contr. to Our Knowledge of the Higher Fungi of China, p. 125. 1939.
CHINA: Hainan, Yen-hsien, 20.VI.1934, Deng, S. Q. 3586, culms of bamboo, as ***Nummularia reyesiana*** (GAM 12823; GZU-Petrak 10357). PHILIPPINES: Los Baños, 20.X.1913, Reyes, S. A. 1906, culms of ***Bambusa vulgaris*** (S, HOLOTYPE of ***Nummularia reyesiana***); Los Baños, I.1913, Baker, C. F. 2407b, culms of ***Schizostachyum*** (S, HOLOTYPE of ***Hypoxylon nummularioides***).
A synonym of ***Hypoxylon nummularioides*** Rehm. Probably a ***Nemania*** S. F. Gray species. Also see Ju and Rogers (1994).

***rufa* (*Nummularia*)** Ellis & Everh. *apud* C. L. Smith, Bull. Lab. Nat. Hist Iowa State Univ. 2: 406. 1893.
= * ***Hypoxylon stygium*** (Lév.) Sacc. *Fide* Ju and Rogers (1996).

rumpens* (*Nummularia*)** (Cooke) Cooke ≡ ***Diatrype rumpens Cooke ≡ ***Anthostoma rumpens*** (Cooke) Sacc. ≡ ***Numulariola rumpens*** (Cooke) P. Martin ≡ * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers

* ***schweinitzii* (*Biscogniauxia*)** Y.-M. Ju & J. D. Rogers

***scriblita* (*Nummularia*)** (Mont.) Cooke, Grevillea 11: 126. 1883.
≡ ***Hypoxylon scriblita*** Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 119. 1855.
≡ ***Numulariola scriblita*** (Mont.) P. Martin, J. S. African Bot. 35: 290. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 79. 1976.
≡ * ***Camillea scriblita*** (Mont.) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 143. 1989.

***scutata* (*Nummularia*)** Berk. & Cooke *apud* Cooke, Grevillea 12: 7. 1883.
MAURITIUS: twigs of ***Magnolia glauca*** (K 32213, HOLOTYPE of ***Nummularia scutata***).
= * ***Whalleya microplaca*** (Berk. & M. A. Curtis) J. D. Rogers, Y.-M. Ju, & San Martín
Also see Rogers et al. (1997).

sertata* (*Nummularia*)** (Durieu & Mont.) Cooke ≡ ***Sphaeria sertata Durieu & Mont. ≡ ***Hypoxylon sertatum*** (Durieu & Mont.) Mont. = * ***Biscogniauxia mediterranea*** (De Not.) Kuntze

***signata* (*Nummularia*)** S. C. Jong & C. R. Benjamin, Mycologia 63: 873. 1971.
≡ * ***Camillea signata*** (S. C. Jong & C. R. Benjamin) Laessøe, J. D. Rogers, & Whalley, Mycol. Res. 93: 149. 1989.

***signata* (*Numulariola*)** Morg. *ex* P. Martin, J. S. African Bot. 35: 291. 1969; [*nom. inval.*, ICBN Arts. 36.1 & 37.1]; J. S. African Bot. 42: 83. 1976.
= * ***Camillea signata*** (S. C. Jong & C. R. Benjamin) Laessøe, J. D. Rogers, & Whalley. *Fide* Laessøe et al. (1989).

* ***simplicior*** (***Biscogniauxia***) Pouzar

* ***sinuosa*** (***Biscogniauxia***) (Theiss.) Y.-M. Ju & J. D. Rogers ≡ ***Nummularia sinuosa*** Theiss. ≡ ***Hypoxylon sinuosum*** (Theiss.) J. H. Miller ≡ ***Numulariola sinuosa*** (Theiss.) P. Martin

spondylina (***Nummularia***) (Fr.: Fr.) Sacc., Syll. Fung. I, p. 401. 1882.
≡ ***Sphaeria spondylina*** Fr.: Fr., Syst. Mycol. II, p. 347. 1823.
≡ ***Hypoxylon spondylinum*** (Fr.: Fr.) Fr., Summa Veg. Scand. II, p. 383. 1849.
= * ***Hypoxylon cohaerens*** (Pers.: Fr.) Fr. *Fide* Ju and Rogers (1996).

starbaeckii (***Nummularia***) Sacc. & Traverso = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

stigmateum (***Hypoxylon***) Cooke = ? ***Biscogniauxia mediterranea*** (De Not.) Kuntze

stygia (***Nummularia***) (Lév.) C. G. Lloyd, Mycol. Writings 7: 1312. 1924.
≡ ***Sphaeria stygia*** Lév., Ann. Sci. Nat. Bot., sér. III, 5: 258. 1846.
≡ * ***Hypoxylon stygium*** (Lév.) Sacc., Syll. Fung. I, p. 379. 1882.

See Ju and Rogers (1996).

subaffixa (***Nummularia***) (Schwein.) Sacc., Syll. Fung. I, p. 401. 1882.
≡ ***Sphaeria subaffixa*** Schwein., Trans. Amer. Philos. Soc., n. ser., 4: 194. 1832.
U.S.A.: Schweinitz, L. V. D., on wood (W 373083, TYPE of ***Sphaeria subaffixa***).

A ***Diatrype*** Fr.

subapiculata (***Nummularia***) Ellis & Everh., J. Mycol. 5: 23. 1889.
= * ***Camillea tinctor*** (Berk.) Laessøe, J. D. Rogers, & Whalley. *Fide* Miller (1961) [as ***Hypoxylon***].

subconcava (***Nummularia***) (Schwein.) Ellis & Everh., N. Am. Pyrenomycetes, p. 623. 1892.
≡ ***Sphaeria subconcava*** Schwein., Trans. Am. Phil. Soc. Philadelphia n. ser. 4: 196. 1832.
U.S.A.: Pennsylvania, Bethlehem, syn. 1251, twigs (PH, HOLOTYPE of ***Sphaeria subconcava***); Pennsylvania, Bethlehem, syn. 1251, Collins Coll. no. 72, twigs (PH, ISOTYPE of ***Sphaeria subconcava***).

A coelomycete.

suborbicularis (***Nummularia***) (Welw. & Curr.) Sacc., Syll. Fung. I, p. 399. 1882.
≡ ***Hypoxylon suborbiculare*** Welw. & Curr., Trans. Linn. Soc., London 26: 281. 1867; *non* Peck, 1879.

Possibly a ***Biscogniauxia***. Also see Ju and Rogers (1996).

suborbicularis (***Nummularia***) (Welw. & Curr.) Sacc. *var.* ***cookeana*** Sacc., Syll. Fung. I, p. 399. 1882.
≡ ***Nummularia cookeana*** (Sacc.) Rehm, Leafl. Philipp. Bot. 6: 2273. 1914.

Miller (1961) considered these two names to be synonyms of ***Hypoxylon sclerophaeum*** Berk. & M. A. Curtis. Unfortunately, the type was not located at K or PAD. A specimen [BPI 10732] identified as this name by C. G. Lloyd is ***Hypoxylon polyporum*** (Starb.) Y.-M. Ju & J. D.

Rogers.

succentralia (***Nummularia***) Torrend, *ined.* = * ***Biscogniauxia mediterranea*** (De Not.) Kuntze

succenturiata (***Nummularia***) (Tode: Fr.) Nitschke, Pyren. Germ., p. 58. 1867.

≡ ***Sphaeria succenturiata*** Tode, Fung. Mecklenb. Sel. II, p. 37. 1791; Tode: Fr., Syst. Mycol. II, p. 347. 1823.

≡ ***Hypoxylon succenturiatum*** (Tode: Fr.) Berk. & Broome, Ann. Mag. Nat. Hist., ser. III, 3: 363 [8]. 1859.

GERMANY: Sachsen, Leipzig, Kunze, G., corticated wood, as ***Sphaeria succenturiata*** (UPS 58312). U.S.A.: Pennsylvania, Bethlehem, syn. 1217, wood, as ***Sphaeria succenturiata*** by Schweinitz, L. D. V. (PH).

The cited specimen at UPS is ***Lopadostoma gastrinum*** (Fr.: Fr.) Traverso. However, the descriptions in Persoon (1801), Fries (1823), and Nitschke (1867) suggest a ***Biscogniauxia*** taxon. The Schweinitz specimen at PH is sterile.

succenturiata (***Nummularia***) (Tode: Fr.) Nitschke *var.* ***laevis*** (Sowerby: Fr.) Sacc., Syll. Fung. I, p. 397. 1882.

≡ ***Sphaeria succenturiata*** Tode: Fr. *var.* ***laevis*** Sowerby, Col. Fig. Engl. Fung. III, Pl. 394, Fig. 8. 1803; Sowerby: Fr., Syst. Mycol. II, p. 347. 1823.

≡ ***Hypoxylon succenturiatum*** (Tode: Fr.) Berk. & Broome *var.* ***laevis*** (Sowerby: Fr.) Berk. & Broome, Ann. Mag. Nat. Hist., ser. III, 3: 363 [8]. 1859.

The identity of this fungus is uncertain.

sulcata (***Numulariola***) (Starb.) P. Martin, J. S. African Bot. 35: 290. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 79. 1976.

≡ ***Hypoxylon sulcatum*** Starb., Ark. Bot. 2: 20. 1904.

≡ * ***Camillea sulcata*** (Starb.) C. G. Lloyd, Mycol. Writings 5: 77. 1918.

tenuis (***Nummularia***) Pass., Nuovo Giorn. Bot. Ital. 7: 186. 1875; *non* Starb., 1905.

We have not studied material of this fungus.

tenuis (***Nummularia***) Starb. *non* Pass. = * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers

testudinea (***Nummularia***) Cooke, Grevillea 12: 7. 1883.

Miller (1961) reported that he could not find spores in the type material at K.

theissenii (***Nummularia***) Syd. & P. Syd. ≡ ***Numulariola theissenii*** (Syd. & P. Syd.) P. Martin ≡ * ***Biscogniauxia capnodes*** (Berk.) Y.-M. Ju & J. D. Rogers *var.* ***theissenii*** (Syd. & P. Syd.) Y.-M. Ju & J. D. Rogers

tinctor (***Nummularia***) (Berk.) Ellis & Everh., N. Amer. Pyren., p. 627. 1892.

≡ ***Sphaeria tinctor*** Berk., J. Bot. (Hooker) 4: 311. 1845.

≡ ***Diatrype tinctor*** (Berk.) Sacc., Syll. Fung. I, p. 200. 1882.

≡ ***Hypoxylon tinctor*** (Berk.) Cooke, Grevillea 11: 133. 1888.

≡ ***Numulariola tinctor*** (Berk.) P. Martin, P. Martin, J. S. African Bot. 35: 317. 1969.

≡ * ***Camillea tinctor*** (Berk.) Laessøe, J. D. Rogers, & Whalley, Mycol.

Res. 93: 145. 1989.

tubulina (***Nummularia***) (Albertini & Schwein.: Fr.) J. H. Miller, Trans. Brit. Mycol. Soc. 17: 134. 1932.

≡ ***Sphaeria tubulina*** Albertini & Schwein., Consp. Fung. Lusat., p. 6. 1805; Albertini & Schwein.: Fr., Syst. Mycol. II, p. 346. 1823.

≡ ***Hypoxylon tubulinum*** (Albertini & Schwein.: Fr.) Fr., Summa Veg. Scand. II, p. 383. 1849.

≡ ***Bolinia tubulina*** (Albertini & Schwein.: Fr.) Sacc., Syll. Fung. I, p. 352. 1882.

≡ ***Ustulina tubulina*** (Albertini & Schwein.: Fr.) Schröt. apud Cohn, Krypt.-Fl. Schlesien III, 2, p. 465. 1897.

≡ ***Numulariola tubulina*** (Albertini & Schwein.: Fr.) P. Martin, J. S. African Bot. 35: 288. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 79. 1976.

≡ * ***Camarops tubulina*** (Albertini & Schwein.: Fr.) Shear, Mycologia 30: 585. 1938. *Fide* Nannfeldt (1972).

tulasnei (***Nummularia***), *sine auct.*

This is ***Biscogniauxia nummularia*** (Bull.: Fr.) Kuntze. We have been unable to locate it in the literature. The following specimen bears this name: AUSTRIA: Südtirol, Üheretsch, Nordrüchen des Gaudberges bei Eppau, 11.IV.1966, Poelt, J. 1264, wood of ***Fagus*** (GZU).

ubatubensis (***Nummularia***) Viégas, Bragantia 7: 27. 1947.

We have not seen material of this fungus.

* ***uniapiculata*** (***Biscogniauxia***) (Penz. & Sacc.) Whalley & Laessøe ≡ ***Nummularia uniapiculata*** Penz. & Sacc. ≡ ***Hypoxylon uniapiculatum*** (Penz. & Sacc.) J. H. Miller ≡ ***Numulariola uniapiculata*** (Penz. & Sacc.) P. Martin

* ***uniapiculata*** (***Biscogniauxia***) (Penz. & Sacc.) Whalley & Laessøe *var.* ***indica*** (Sacc.) Y.-M. Ju & J. D. Rogers ≡ ***Nummularia punctulata*** (Berk. & Ravenel) Sacc. *var.* ***indica*** Sacc.

* ***uniapiculata*** (***Biscogniauxia***) (Penz. & Sacc.) Whalley & Laessøe *var.* ***macrospora*** (J. D. Rogers) Whalley & Laessøe ≡ ***Hypoxylon uniapiculatum*** (Penz. & Sacc.) J. H. Miller *var.* ***macrosporum*** J. D. Rogers

urceolata (***Nummularia***) Rehm, Philipp. J. Sci. 8: 187. 1913.

≡ * ***Hypoxylon urceolatum*** (Rehm) Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 232. 1996.

ustulinoides (***Nummularia***) Henn., Hedwigia 36: 227. 1897.

≡ * ***Camarops ustulinoides*** (Henn.) Nannf., Svensk Bot. Tidskr. 66: 370. 1972.

venezuelensis (***Nummularia***) J. H. Miller *apud* Chardon & Toro, Monogr. Univ. Puerto Rico, ser. B, 2: 209. 1934.

≡ ***Numulariola venezuelensis*** (J. H. Miller) P. Martin, J. S. African Bot. 35: 291. 1969; [*nom. inval.*, ICBN Art. 33.2]; J. S. African Bot. 42: 79. 1976.

≡ * ***Camillea venezuelensis*** (J. H. Miller) Dennis, Kew Bull., Add. Ser. 3: 296. 1970.

vernicosa (***Nummularia***) Ellis & Everh. *apud* C. L. Smith, Bull. Iowa Univ. Lab. Nat. Hist. 2: 406. 1893.
= * ***Camillea leprieurii*** Mont. *Fide* Laessøe et al. (1989).
viridis (***Nummularia***) Theiss., Ann. Mycol. 6: 350. 1908.
≡ * ***Jumillera viridis*** (Theiss.) J. D. Rogers, Y.-M. Ju, & San Martín, Mycotaxon 64: 47. 1997.
BRAZIL: São Leopoldo, corticated wood, as ***Nummularia viridis*** (S). Also see Rogers et al. (1997).
* ***waitpela*** (***Biscogniauxia***) Van der Gucht
* ***weldenii*** (***Biscogniauxia***) (J. D. Rogers) Whalley & Laessøe ≡ ***Hypoxylon weldenii*** J. D. Rogers
* ***weldenii*** (***Biscogniauxia***) (J. D. Rogers) Whalley & Laessøe *var.* ***microspora*** (J. D. Rogers) Whalley & Laessøe ≡ ***Hypoxylon weldenii*** J. D. Rogers, *var.* ***microsporum*** J. D. Rogers
wrightii (***Nummularia***) (Berk. & M. A. Curtis) Sacc., Syll. Fung. I, p. 398. 1882.
≡ ***Hypoxylon wrightii*** Berk. & M. A. Curtis *apud* Berk., J. Linn. Soc., Bot. 10: 383. 1869.
CUBA: Wright, C. 330 & 494, wood (K, SYNTYPES of ***Hypoxylon wrightii***); Wright, C., wood (K [Cooke herb.], LECTOTYPE [selected by Rogers et al. (1994)] of ***Hypoxylon wrightii***).
= * ***Neohypodiscus cerebrinus*** (Fée) J. D. Rogers, Y.-M. Ju, & Laessøe. *Fide* Rogers et al. (1994).
* ***zelandica*** (***Biscogniauxia***) Y.-M. Ju & J. D. Rogers

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FIGURE LEGENDS

Figs. 1–8. ***Biscogniauxia albosticta*, *B. arima*, *B. fuscella*, *B. nummularia*, *B. pithodes*, and *B. reticulospora*.** 1. ***B. nummularia*** (GZU 88-84). Stromata in various stages: a. immature stroma overlain with a host epidermis; b. immature stroma with the overlying host epidermis partially dehisced and with the outer dehiscing layer partially exposed; c. maturing stroma partially overlain with an outer dehiscing layer; and d. fully mature stroma; X1.66. 2. ***B. albosticta*** (isotype; GAM 2000). Stroma, X2. 3. ***B. fuscella*** (isotype; GAM 2475). Stroma, the arrowhead pointing to a fragment of the white outer dehiscing layer; X2.5. 4. ***B. arima*** (holotype). Stroma, X5.5. 5, 6. ***B. reticulospora*** (holotype). 5. Stroma, X2.5. 6. Stromatal surface, X16. 7, 8. ***B. pithodes***. 7. Stroma, the arrowhead pointing to a fragment of the white outer dehiscing layer; X1. 8. Stromatal surface, X16.

Figs. 9–18. ***Biscogniauxia communapertura*, *B. dennisii*, *B. mediterranea*, *B. plumbea*, and *B. zelandica*.** 9–11. ***B. mediterranea*** (F. Candoussau 366; JDR). 9. Stroma, the arrowhead pointing to the thick outer dehiscing layer remaining at margins; X1. 10. Vertical section of an outer dehiscing layer (arrowhead) and perithecial stroma (p); X10. 11. Stromatal surface, X16. 12. ***B. zelandica*** (holotype). Stromata, X1. 13, 14. ***B. plumbea*** (holotype). 13. stromata, X1. 14. Stromatal surface, X16. 15. ***B. dennisii*** (holotype). Stroma, the arrowhead pointing to the outer dehiscing layer remaining at margins; X2. 16–18. ***B. communapertura*** (holotype). 16, 17. Stromata with widely spaced, coarsely papillate ostiolar openings; X8. 18. Perithecia arranged in a rosette; X16.

Figs. 19–24. ***Biscogniauxia africana*, *B. baileyi*, *B. kalchbrenneri*, *B. querna*, and *B. simplicior*.** 19. ***B. simplicior*** (holotype). Stroma, X5. 20. ***B. baileyi*** (holotype). Stromata, X3. 21. ***B. africana*** (holotype). Stromata, X3. 22, 23. ***B. querna*** (holotype). 22. Stroma, the arrowhead pointing to raised margins which originate from the outer dehiscing layer; X6. 23. Vertical section of a stroma showing that the tissue (h) beneath the perithecial layer (p) is enclosed in a dark zone line (z) which is a downward extension of the raised margin (arrowhead); X6. 24. ***B. kalchbrenneri*** (type; K). Stromata, X3.33.

Figs. 25–34. ***Biscogniauxia capnodes*, *B. plana*, *B. reticulospora*, *B. schweinitzii*, and *Nummularia diatrypeoides*.** 25–28. ***B. schweinitzii*** (BPI 590092). 25–27. Stromata, X1.8. 28. Stromatal surface, X16. 29, 30. ***B. plana*** (isotype; K). 29. Stromata, X2.25. 30. Stromatal surface, X16. 31. ***B. capnodes*** (Y.-M. Ju 77031509; JDR). Stromata, X1.33. 32, 33. ***N. diatrypeoides*** (holotype). 32. Stromata, X1.4. 33. Stromatal surface, X16. 34. ***B. reticulospora*** (holotype). Ascospore showing shallow reticulation by SEM; X2,000.

Figs. 35–59. Ascospores and ascus tips. 35. ***B. albosticta*** (holotype). 36. ***B. cinereolilacina*** (isotype; NY). 37. ***B. africana*** (holotype). 38. ***B.***

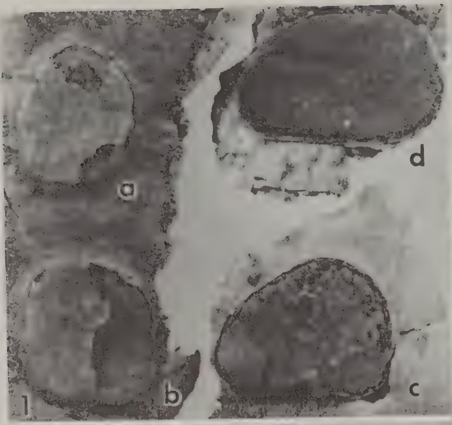
citriformis (holotype). 39. ***B. capnodes*** (holotype). 40. ***B. capnodes var. theissenii*** (holotype). 41. ***B. capnodes var. limoniispora*** (holotype). 42. ***B. communapertura*** (holotype). 43. ***B. divergens*** (lectotype). 44. ***B. fuscella*** (holotype). 45. ***B. grenadensis*** (holotype). 46. ***B. marginata*** (lectotype). 47. ***B. mucigera*** (holotype). 48. ***B. nummularia*** (L 910, 269-131). 49. ***B. philippinensis*** (holotype). 50. ***B. arima*** (holotype). 51. ***B. querna*** (holotype). 52. ***B. repanda*** (type; UPS). 53. ***B. waitpela*** (holotype). 54. ***B. plumbea*** (holotype). 55. ***B. "pruni"*** (C. Scheuer 3139; JDR, *ex* GZU). 56. ***B. uniapiculata var. indica*** (holotype). 57. ***B. reticulospora*** (holotype). 58. ***B. sinuosa*** (type; GAM 12815). 59. ***B. zelandica*** (holotype). The scale bar represents 10 µm.

Fig. 60. ***Biscogniauxia capnodes*** (Y.-M. Ju 77031509); conidiogenous structures and conidia. The scale bar represents 10 µm.

Fig. 61. ***Biscogniauxia uniapiculata*** (Y.-M. Ju 77071406); conidiogenous structures and conidia. The scale bar represents 10 µm.

Figs. 62–65. Conidiogenous structures and conidia. 62. ***B. plumbea*** (from holotype material). 63. ***B. citriformis*** (Y.-M. Ju 80091106). 64. ***B. pruni*** (C. Scheuer 3139). 65. ***B. bartholomaei*** (B. Callan, DAVFP 25111). The scale bar represents 10 µm.

Figs. 66–69. Conidiogenous structures and conidia. 66. ***B. arima*** (from holotype material). 67. ***B. simplicior*** (F. Candoussau 5354A). 68. ***B. atropunctata*** (L. F. Grand, from North Carolina). 69. ***B. atropunctata var. intermedia*** (D. J. Lodge & G. Bills, CR-491). The scale bar represents 10 µm.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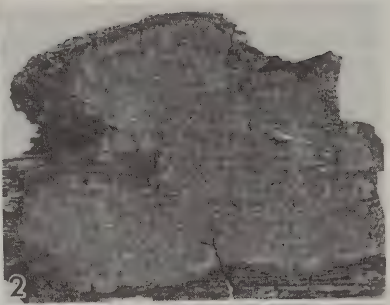
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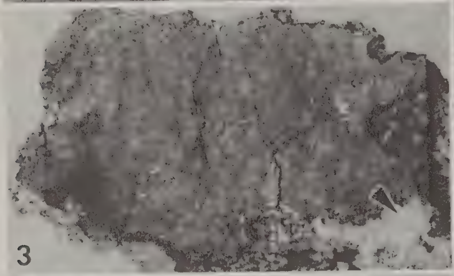
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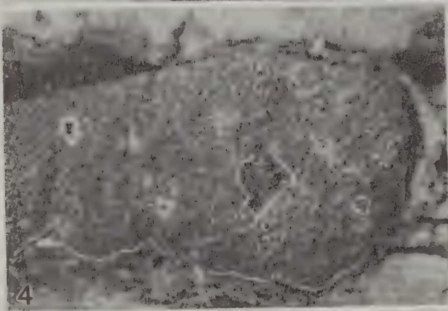
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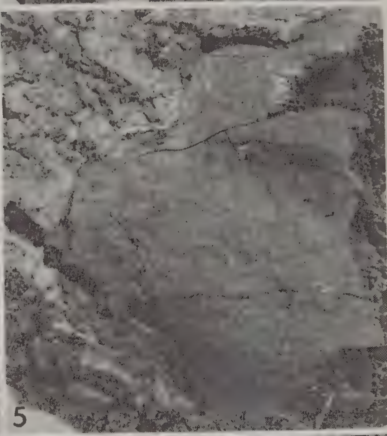
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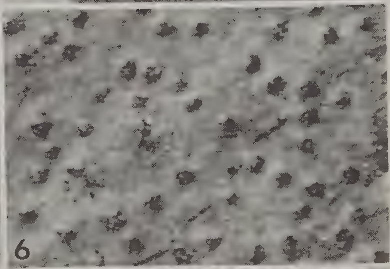
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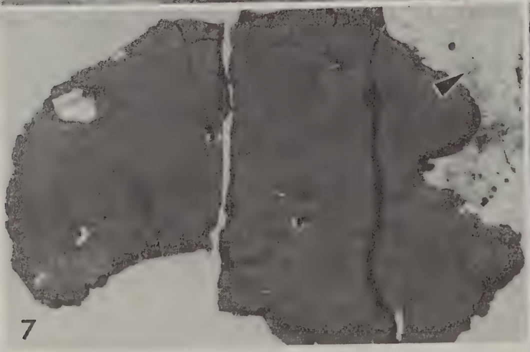
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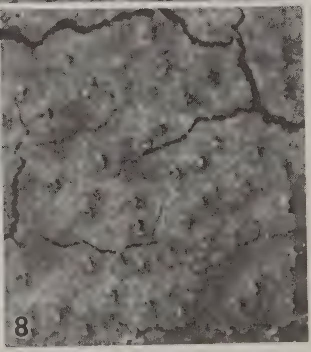
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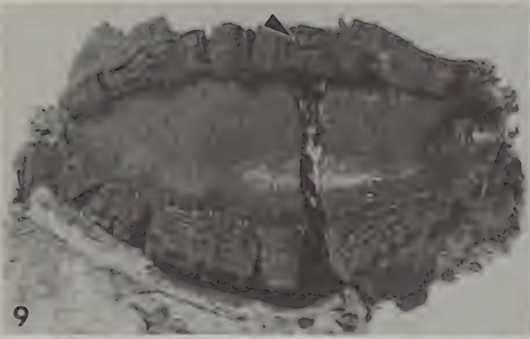
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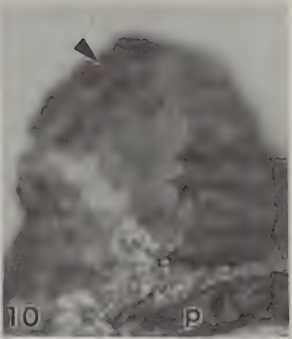
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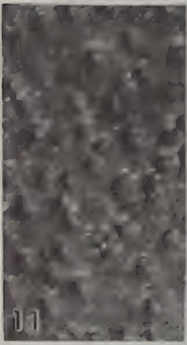
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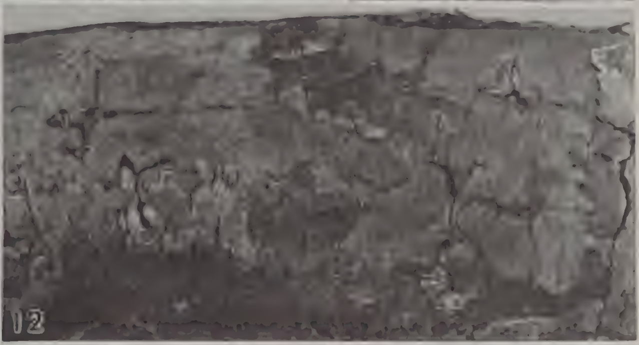
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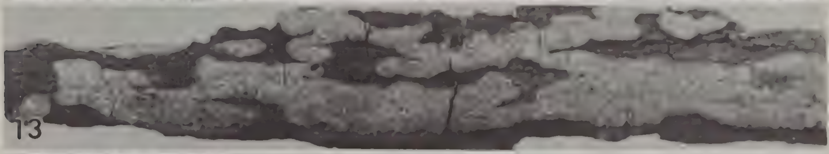
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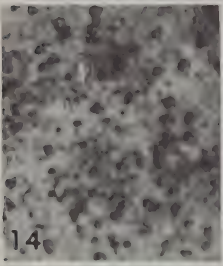
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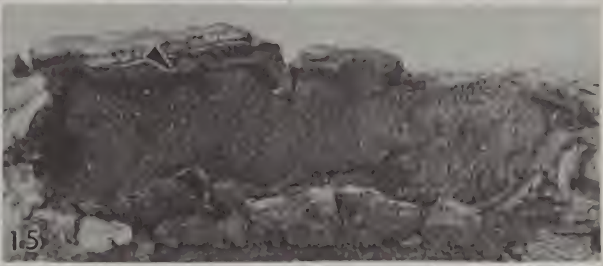
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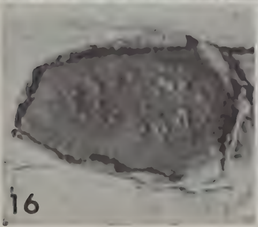
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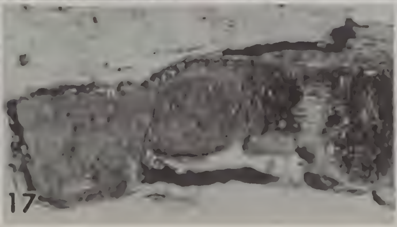
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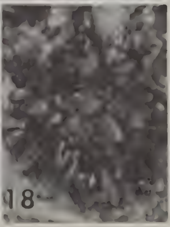
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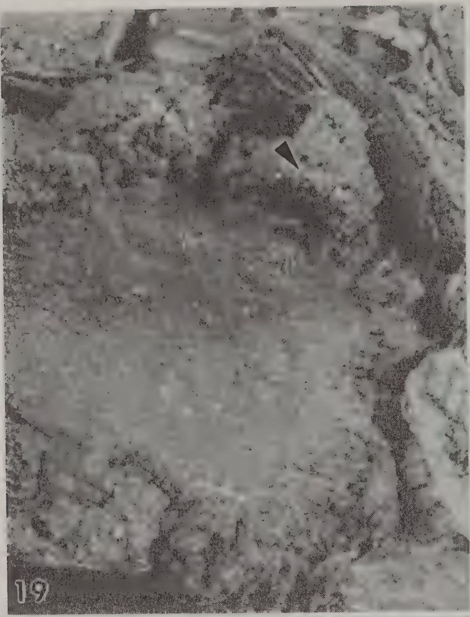
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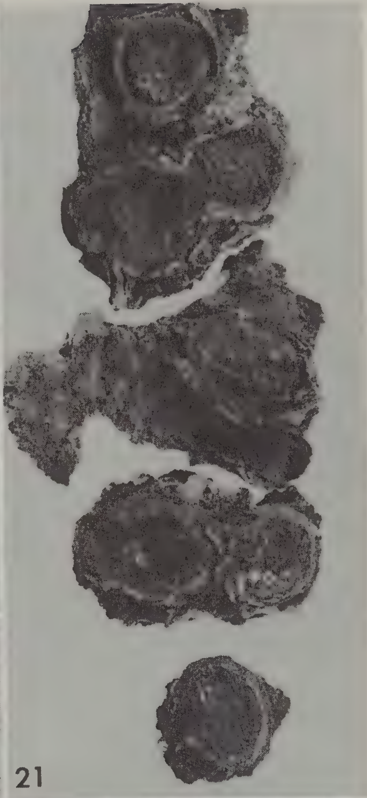
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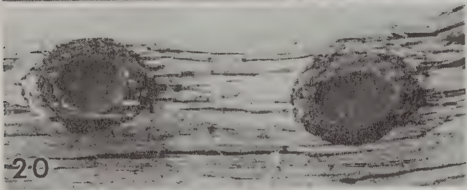
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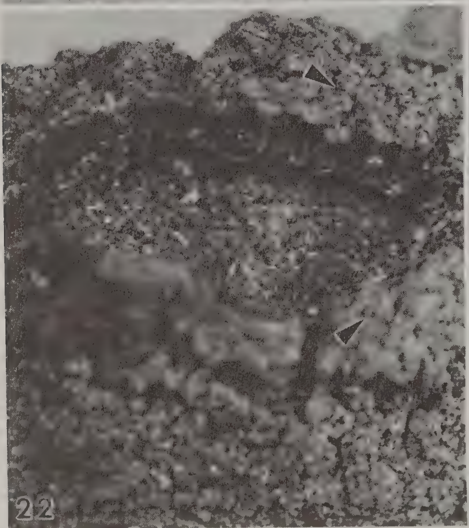
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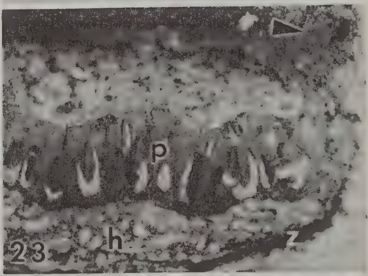
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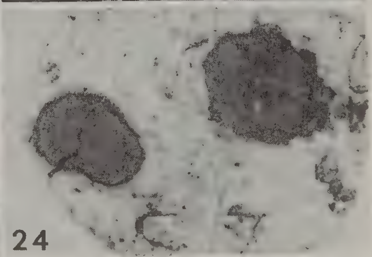
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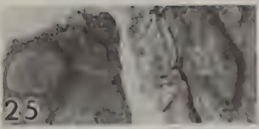
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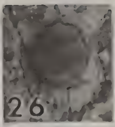
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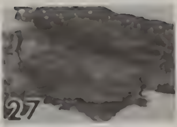
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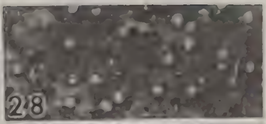
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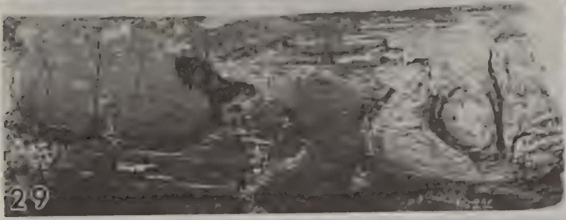
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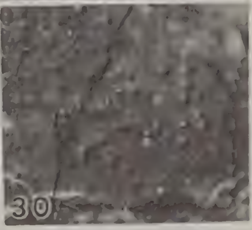
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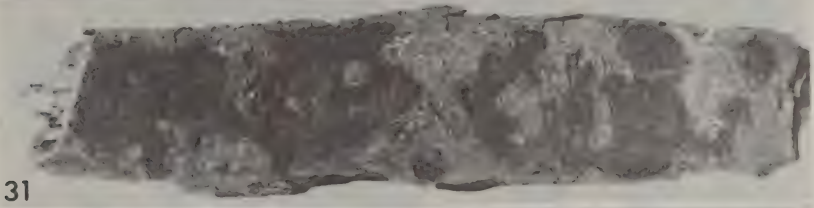
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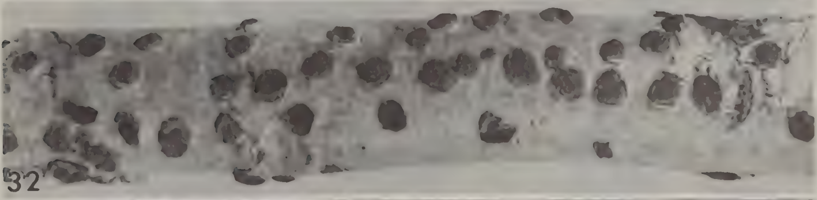
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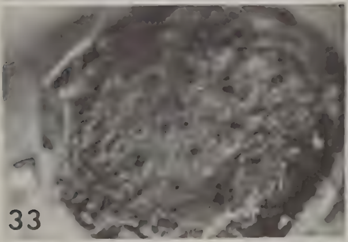
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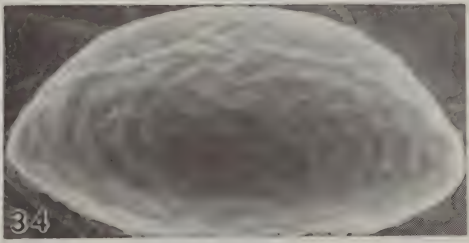
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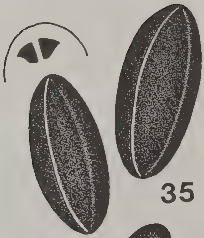
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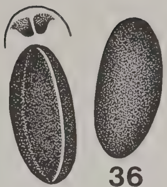
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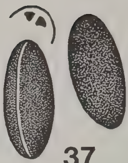
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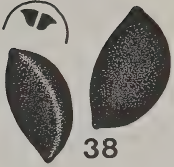
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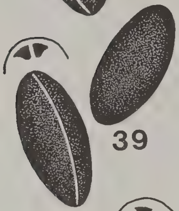
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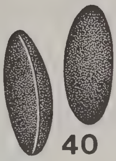
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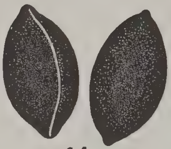
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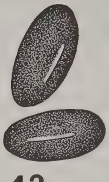
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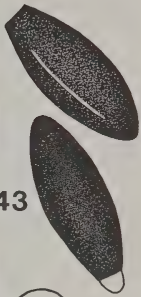
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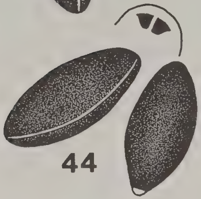
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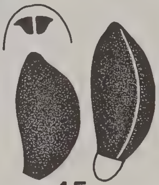
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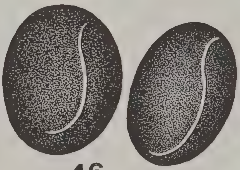
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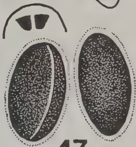
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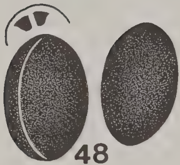
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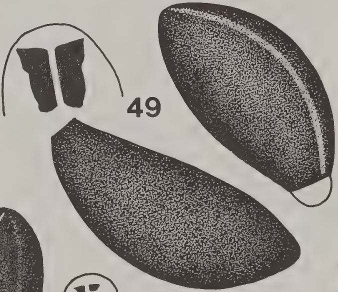
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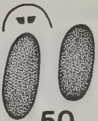
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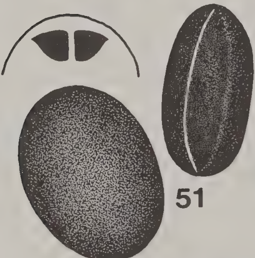
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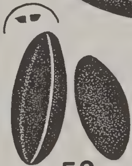
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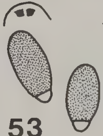
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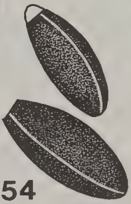
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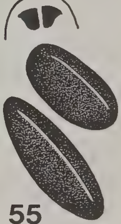
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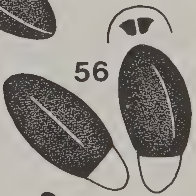
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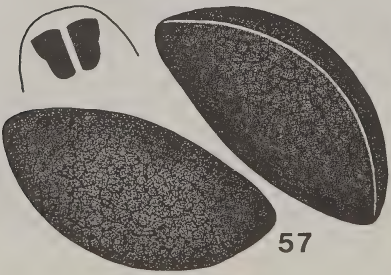
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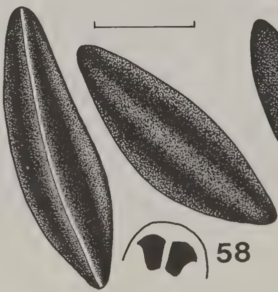
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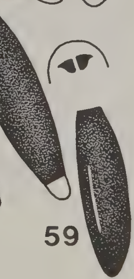
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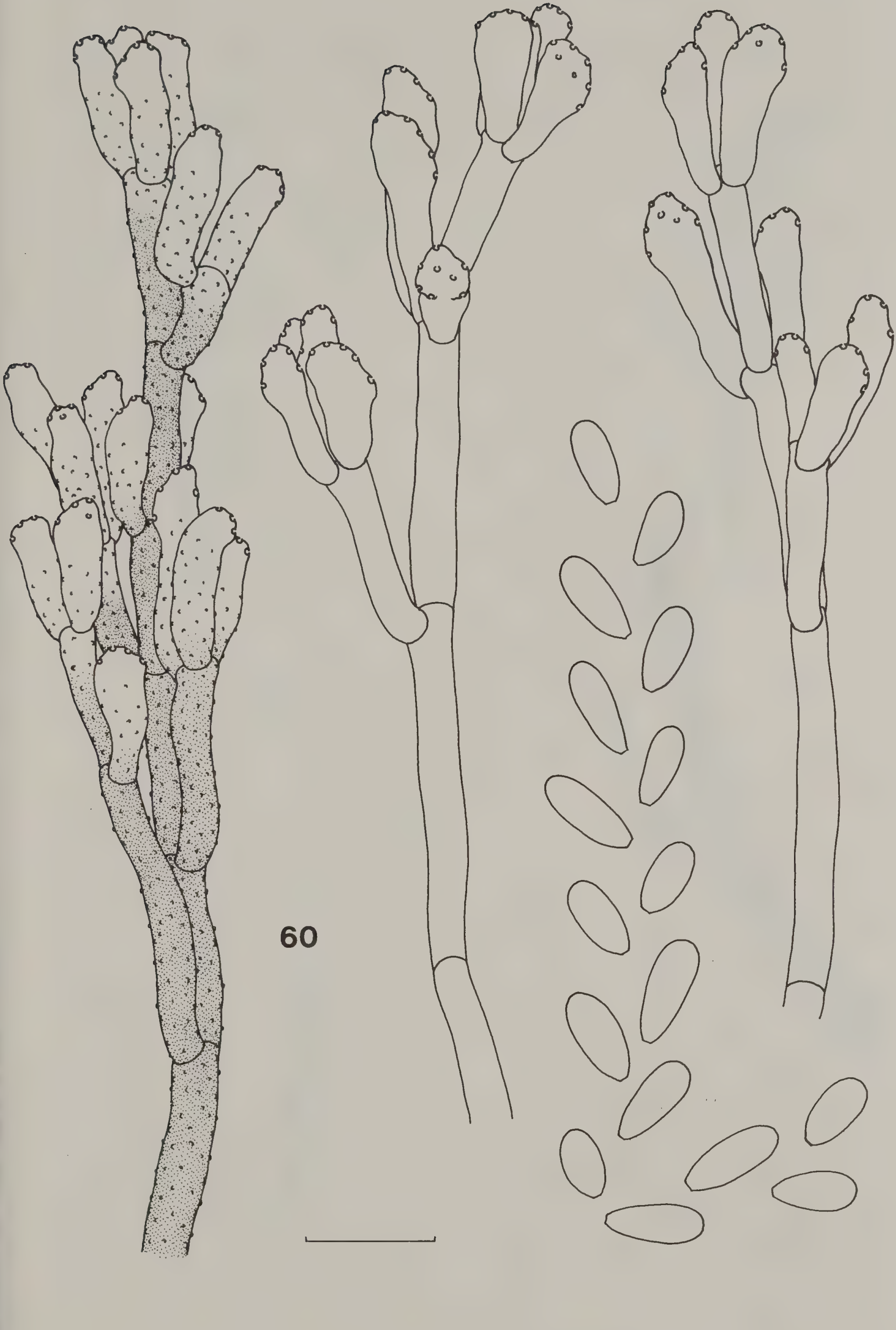

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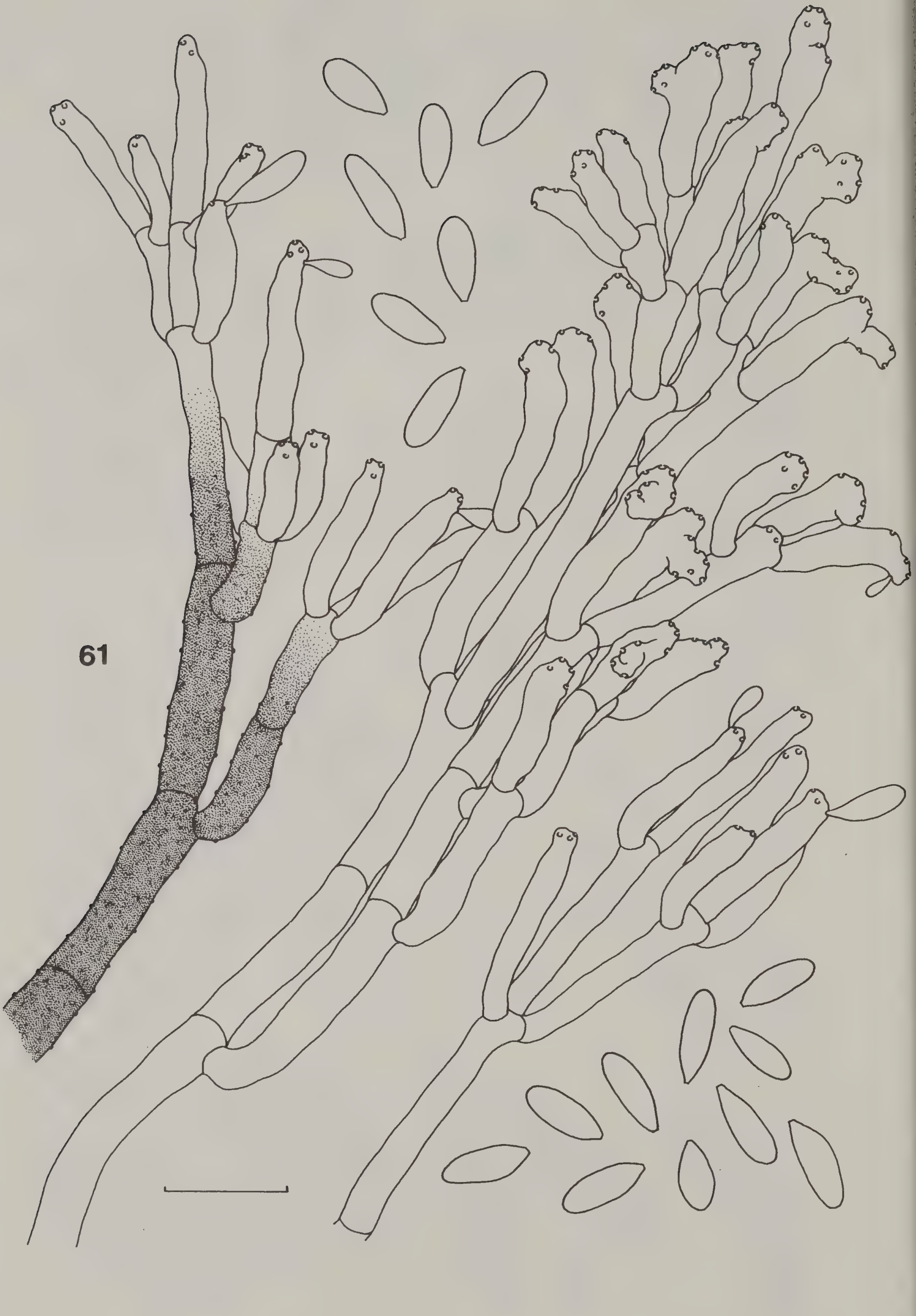
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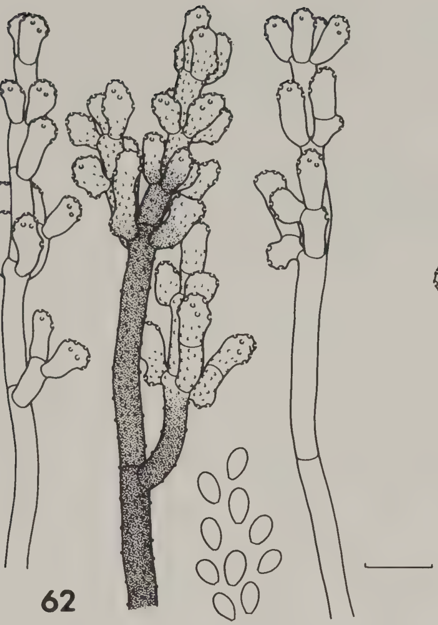
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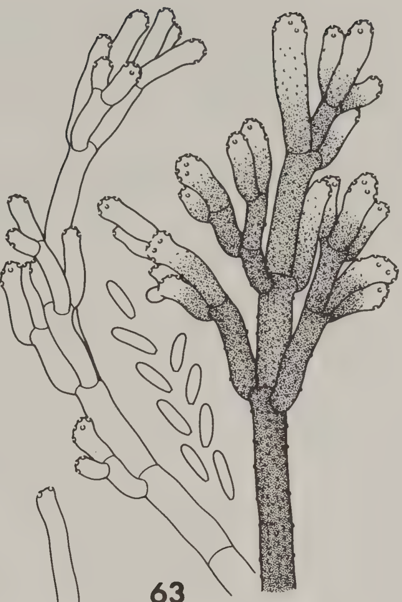
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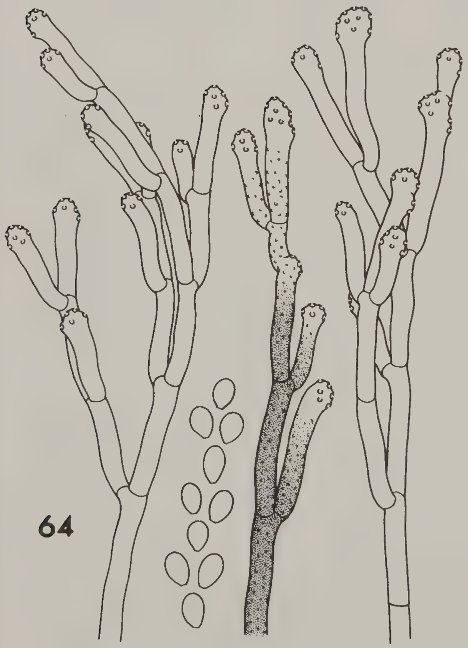
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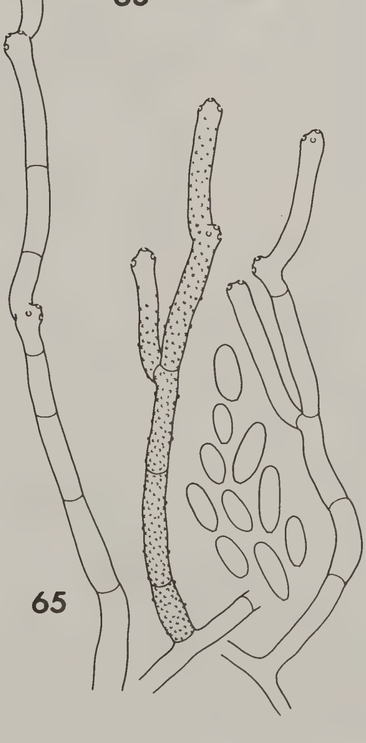
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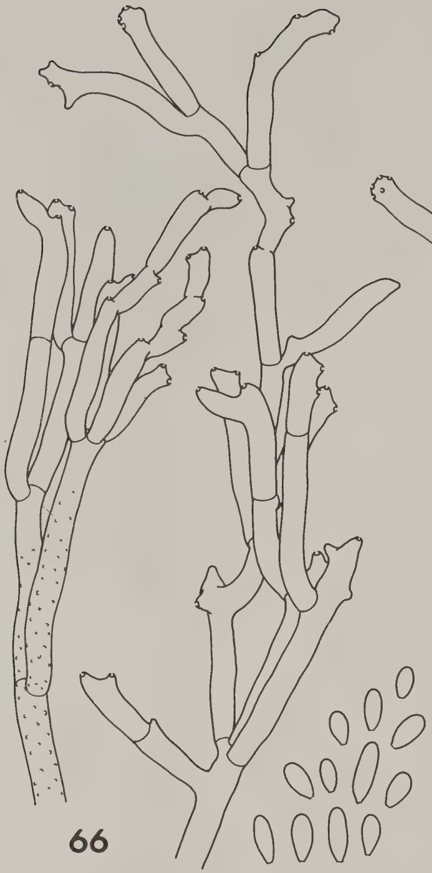

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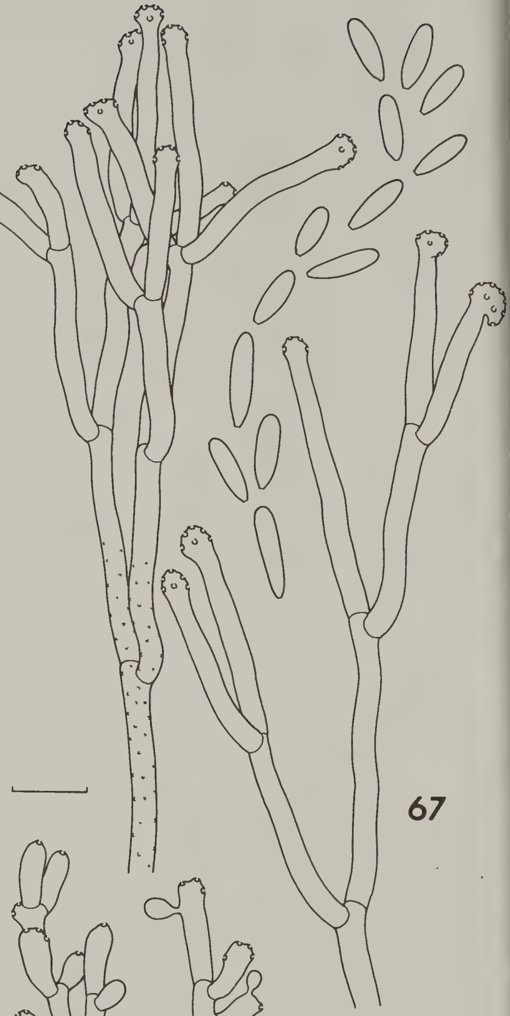

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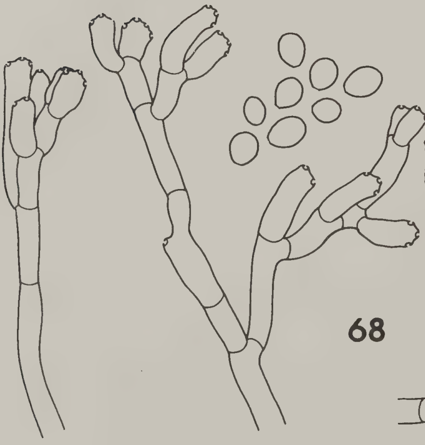

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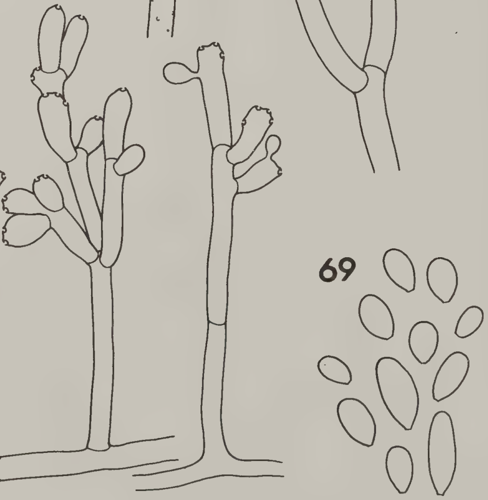

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VALIDATION OF THE NAMES OF THREE *CANDIDA* SPECIES

Sally A. Meyer[1] and David Yarrow[2]

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Abstract

The names of three *Candida* species, *C. atlantica, C. cylindracea* and *C. quercitrusa* are validated.

Keywords: *CANDIDA*, *C. atlantica, C. cylindracea, C. quercitrusa*

While preparing the chapter on *Candida* Berkhout for the fourth edition of *The Yeasts, A Taxonomic Study* [C. P. Kurtzman & J. W. Fell (Eds.) Elsevier Science Publishers, Amsterdam, in press], it was noticed that the names of three species, *C. atlantica, C. cylindracea* and *C. quercitrusa* had not been validly published. The purpose of this communication is to correct these oversights.

Van Uden and Buckley (1970) reported that *Trichosporon atlanticum* did not form arthrospores and identified it as *C. diddensiae* (published as *C. diddensii*) because it has similar morphological and physiological characteristics. However, DNA reassociation experiments of Meyer & Simione (1978) showed that *T. atlanticum* and *C. diddensiae* are insufficiently related to be considered the same species. Subsequently, Meyer *et al*. (1984) and Barnett *et al.* (1990) cited the species as "*Candida atlantica* (Siepmann) S.A. Meyer & Simione (1983 in press)", but the combination was never published.

Candida atlantica (Siepmann) S. A. Meyer & Simione nov. comb.
Basionym: *Trichosporon atlanticum* Siepmann *in* Siepmann & Höhnk 1962. Veröffentluchungen des Instituts für Meeresforschung in Bremerhaven 8: 90. CBS 5263 was designated as type.

A strain of yeast which is able to produce lipase was described as *Candida cylindracea* by Yamada and Machida (1962) without a description in Latin. The strain was later identified as *Candida zeylanoides* (Castellani) Langeron & Guerra because of similarities in morphology and physiology. However, because of the difference of approximately 5% in the guanine plus cytosine content of the nuclear DNA, *C. cylindracea* is now recognized as a species in its own right. Therefore, a Latin description is given to validate the name.

Candida cylindracea K. Yamada & Machida ex S. A. Meyer & Yarrow
Cellulae elongatae vel cylindricae, 4.0-12.0 x 2.0-5.0 μm; pseudohyphae praesentes; fermentat glucosum lente; crescit in medio definito cum D-glucoso, D-galactoso, L-sorboso, glycerolo, D-glucitolo, D-mannitolo, D-glucono-1,5 lactono, 2 keto-D-glucoso, lactato (lente), succinato, citrato, ethanolo, 2-propanolo, ethylamino, et cadaverino; crescit 30°C; G+C acidi deoxyribonucleati 62.7 mol%. Typus CBS 6330, ex solo, in collectione Centraalbureau voor Schimmelcultures.

C. parapsilosis var. *querci* was described by van Uden & do Carmo-Sousa (1959). Later, van Uden & Buckley (1970) placed it in synonymy with *C. parapsilosis*. Meyer and Phaff (1972) found only insignificant DNA relatedness between the type strain of *C. parapsilosis* var. *querci* and the type strain of *C. parapsilosis* and concluded that *C. parapsilosis* var. *querci* should be recognized as a separate species, but did not propose a name. Montrocher and Claisse (1984) also concluded that these yeasts are distinct species and proposed the name *Candida quercus* (published as *querci*), but this is a later homonym of *Candida quercuum* Nakase (1971) and illegitimate under Article 53.2 of the International Code of Botanical Nomenclature (Index of Fungi 5, 422, 1986). Therefore, the species has to be renamed. It was cited as *Candida quercitrusa* (van Uden & do Carmo-Sousa) Meyer & Phaff in subsequent works, however, the name was never formally published.

Candida quercitrusa van Uden & do Carmo-Sousa S. A. Meyer & Phaff nov. nom. Replaced synonym: *Candida parapsilosis* (Ashford) Langeron & Talice var. *querci* van Uden & do Carmo-Sousa 1959. Portugalae Acta Biologica (B) 6, 246. Type strain CBS 4412 from frass of insects in oak tree, *Quercus* sp.

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van Uden, N. & L. Do Carmo-Sousa. 1959. Further studies on the significance of temperature relations and vitamin deficiency patterns in yeast taxonomy. With descriptions of *Candida parapsilosis* var. *querci* nov. var. , *C. obtusa* nov. comb. and *C. lusitaniae* nov. sp. Port. Acta Biol. (B) 6:239-256.

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MELIOLACEAE OF KERALA, INDIA–II

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Abstract

This paper gives an account of three new species and a new variety of the Meliolaceae collected from Kerala State. *Asteridiella crontonicola, Meliola farenheitiae, M. panici* Earle var. *macropoda* and *M. pushpangadanii* are described and illustrated.

Key words: Meliolaceae, new taxa, Kerala, India

*1. **Asteridiella crotonicola*** Hosagoudar and Abraham *sp. nov.* (Fig. 1)

Coloniae epiphyllae, densae, ad 2 mm diam., raro confluentes. Hyphae flexuosae vel anfractuae, plerumque opposite laxe ramosae, laxe vel dense reticulatae, cellulae 20-31 x 6-7.5 μm. Hyphopodia alternata, antrorsa, subantrorsa vel patentia, 28-34 μm longa; cellula basali cylindracea vel cuneata, 9-12 μm longa; cellula apicali ovata, globosa, recta vel varie curvula, integra vel plerumque irregulariter angulosa vel leniter lobata, 19-21.5 x 14-19.5 μm. Phialides numerosa, illis hyphopodiis commixtra, alternata vel opposita, ampullacea, collum strepta, 14-17 x 4.5-7 μm. Perithecia dispersa, ad 120 μm diam., cellulae peritheciales conoideae, ad 13 μm longae; ascosporae cylindraceae vel oblongae, 4-septatae, contrictae, 43-51 x 16-21 μm.

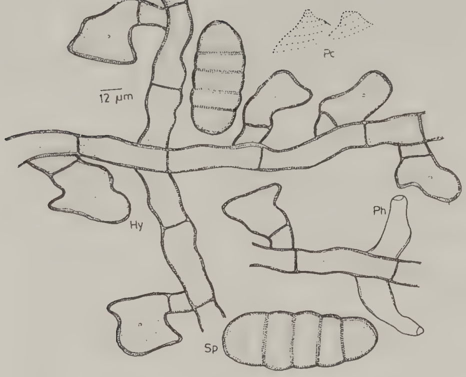
Pc
12 µm
Hy
Ph
Sp

Fig. 1. *Asteridiella crotonicola*

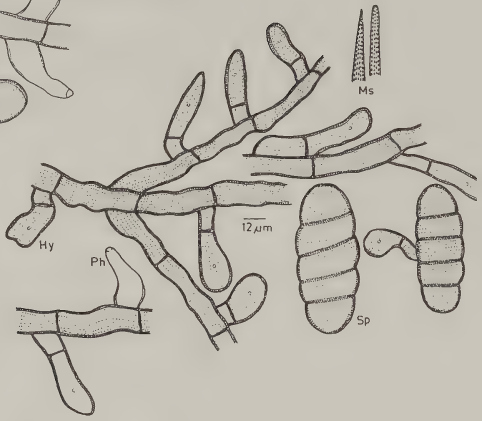
Ms
12 µm
Hy
Ph
Sp

Fig. 2. *Meliola farenheitiae*

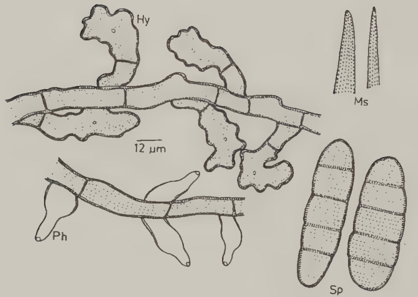
Hy
Ms
12 µm
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Fig. 3. *Meliola panici* var. *macropoda*

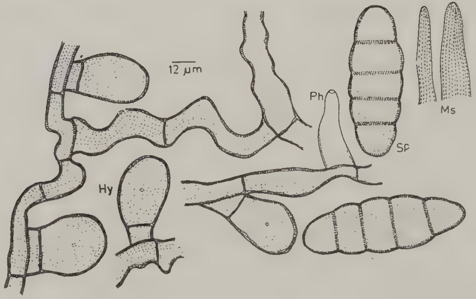
12 µm
Ph
Ms
Sp
Hy

Fig. 4. *Meliola pushpangadanii*

Key to Abbreviations: Hy = Hyphopodia, Ms = Mycelial setae, Pc = Perithecial cells, Ph = Phialides, Sp = Ascospores

Colonies epiphyllous, dense, up to 2 mm in diameter, rarely confluent. Hyphae flexuous to crooked, branching mostly opposite at wide angles, loosely to closely reticulate, cells 20-31 x 6-7.5 μm. Hyphopodia alternate, antrorse, subantrorse to spreading, 28-34 μm long; stalk cells cylindrical to cuneate, 9-12 μm long; head cells ovate, globose, straight to variously curved, entire to mostly irregularly angular to slightly lobate, 19-21.5 x 14-19.5 μm. Phialides fairly numerous, mixed with hyphopodia, alternate to opposite, ampulliform, neck twisted, 14-17 x 4.5-7μm. Perithecia scattered, up to 120 μm in diam.; perithecial cells conoid, up to 13 μm long; ascospores cylindrical to oblong, 4-septate, constricted at the septa, 43-51 x 16-21 μm.

Holotype: On leaves of *Croton malabaricus* Muell.-Arg. (Euphorbiaceae), in the forest near Kombe, Meenmutty, Thiruvananthapuram, Kerala, India, April 19, 1996, V.B. Hosagoudar HCIO 42139.

Asteridiella crotonis Hosag. is known on this host genus. The new species differs from it in having epiphyllous colonies, irregularly angular head cells of the hyphopodia and larger ascospores (Hosagoudar & Goos, 1989). It also differs from *Asteridiella alcorneae-incurvae* Hansf. (which has the same Beeli formula, 3101.5320) in having smaller hyphopodia, irregularly curved and angular head cells of the hyphopodia and smaller ascospores. Hence, a new species is proposed.

2. ***Meliola farenheitiae*** Hosagoudar et Abraham *sp. nov.* (Fig. 2)

Coloniae hypophyllae, densae, velutinae, ad 10 mm diam., raro confluentes. Hyphae rectae vel subrectae, plerumque opposite acuteque ramosae, laxe reticulatae, cellulae 24-29 x 5-6 μm. Hyphopodia alternata, antrorsa, subantrorsa, patentia vel recurvata, 14-26.5 μm longa; cellula basali cylindracea vel cuneaata, 4.5-12 μm longa; cellula apicali recta vel varie curvula, ovata, globosa, cylindracea, oblonga, integra, raro angularia, 9.5-14.5 x 5.5-12 μm. Phialides illis hyphopodiis commixta, alternata vel opposita, elongata, cylindracea vel ampullacea, collum elongata et strepta, 16-21.5 x 5.5-12 μm. Setae myceliales numerosae, dispersae vel juxta perithecia aggregatae, simplices plerumque rectae, saepe flexuosae vel curvulae, acutae vel obtusae ad apicem, ad 342 μm longae. Perithecia dispersa, ad 144 μm diam. Ascosporae cylindraceae vel oblongae, 4-septatae, constrictae, 33-36 x 12-14.5 μm.

Colonies hypophyllous, dense, velvety, up to 10 mm in diameter, rarely confluent. Hyphae straight to substraight, branching mostly opposite at acute angles, loosely reticulate, cells 24-29 x 5-6 μm. Hyphopodia alternate, antrorse, subantrorse, spreading to recurved, 14-26.5 μm long; stalk cells cylindrical to cuneate, 4.5-12 μm long; head cells straight to variously curved, ovate, globose, cylindrical, oblong, entire, rarely angular, 9.5-14.5 x 5.5-12 μm. Phialides mixed with hyphopodia, alternate to opposite, elongated, cylindrical to ampulliform, neck elongated and twisted, 16-21.5 x 5.5-12 μm. Mycelial setae numerous, scattered to grouped around perithecia, simple, mostly straight, often flexuous to curved, acute to obtuse at the tip, up to 342 μm long. Perithecia scattered, up to 144 μm in diam.; ascospores cylindrical to oblong, 4-septate, constricted at the septa, 33-36 x 12-14.5 μm.

Holotype: On leaves of *Farenheitia zeylanica* (Thw.) Airyshaw (*Ostodes zeylanicus* (Thw.) Muell.-Arg). (Euphorbiaceae), in the forest of the Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram, Kerala, India, March 4, 1996, V.B. Hosagoudar HCIO 42158.

Meliola ostodis Kapoor is known on this host from Sikkim, India (Kapoor, 1967). The new species differs from it in having hypophyllous colonies, longer and only alternate hyphopodia, cylindrical head cells of the hyphopodia. The new species can also be compared with *Meliola jatrophae* Stev. var. *adeliae* Cif. (having Beeli formula 3111.3222), from which it differs in having elongate-cylindric head cells of the hyphopodia, phialides with hyphopodia and longer ascospores (Hansford, 1961).

3. ***Meliola panici*** Earle var. ***macropodia*** Hosagoudar et Abraham *var. nov.* (Fig. 3)

Peraffinis *Meliola panici* Earle differt a var. *panici* hyphopodiis et setae myceliales longioribus.

Colonies amphigenous, subdense, 2 mm in diameter, confluent and covering entire leaf surface and leaf sheaths. Hyphae straight, flexuous to crooked, branching opposite to irregular at acute to wide angles, loosely to closely reticulate, cells 26-30 x 7-8 μm. Hyphopodia alternate, antrorse, subantrorse, retrorse, spreading, 21-30 μm long; stalk cells cylindrical to cuneate, 12-14.5 μm long; head cells ovate, globose, entire, angular, slightly to 1-2 times deeply lobate, 7-19.5 x 9-17 μm. Phialides borne on a separate mycelial branch, alternate to opposite, ampulliform, 14-17 x 7-8 μm. Mycelial setae fairly numerous, scattered to grouped around perithecia, simple, straight to slightly curved, acute at the tip, up to 600 μm long. Perithecia scattered, up to 145 μm in diam.; ascospores oblong to cylindrical, 4-septate, slightly constricted at the septa, 33-41 x 10-12 μm.

Holotype: On leaves and leaf sheaths of *Cyrtococcum longipes* (Wight & Arn. ex Hook. f.) Camus (Poaceae), in the forest near Kombe, Meenmutty, Thiruvananthapuram, Kerala, India, March 11, 1996, V.B. Hosagoudar HCIO 42169.

This collection is assignable to *Meliola panici* Earle but differs from the var. *panici* in having longer hyphopodia and mycelial setae (Hansford, 1961).

4. ***Meliola pushpangadanii*** Hosagoudar and Abraham, *sp. nov.* (Fig. 4)

Coloniae hypophyllae, tenues, despersae, patentiae, ad 5 mm diam. Hyphae anfractuae, irregulariter acuteque vel laxe ramosae, laxe reticulatae, cellulae 36-50 x 4.5-7.5 μm. Hyphopodia dispersa, alternata, antrorsa, subantrorsa vel patentia, recta vel curvula, 19-22 μm longa; cellula basali cylindracea vel cuneata, 4.5-10 μm longa; cellula apicali globosa, 14.5-17 x 17-19.5 μm. Phialides illis hyphopodiis commixtis, alternatis vel oppositis, ampullaceus, 19.5-24 x 9.5-12 μm. Setae myceliales plerumque juxta perithecia, aggregatae, simplices, rectae vel flexuosae, acutae ad apicem, ad 1554 µm longae. Perithecia dispersa, ad 218 µm diam.; ascosporae leniter fusiformae, 4-septatae, constrictae, 40-42 x 17-18 µm.

Colonies hypophyllous, thin, scattered, spreading, up to 5 mm in diameter. Hyphae crooked, braching irregular at acute to wide angles, loosely reticulate, cells 36-50 x 4.5-7.5 µm. Hyphopodia scattered, alternate, antrorse, subantrorse to retrorse, straight to curved, 19-22 µm long; stalk cells cylindrical to cuneate, 4.5-10 µm long; head cells globose, entire, 14.5-17 x 17-19.5 µm. Phialides mixed with hyphopodia, alternate to opposite, ampulliform, 19.5-24 x 9.5-12 µm. Mycelial setae mostly grouped around perithecia, simple, straight to flexuous, acute at the tip, up to 1554 µm long. Perithecia scattered, up to 218 µm in diam.; ascospores slightly fusiform, 4-septate, constricted at the septa, 40-42 x 17-18 µm.

Holotype: On leaves of *Cryptocareya bourdillonii* Gamble (Lauraceae), Athirumala forest, Neyyar Wildlife Sanctuary, Thiruvananthapuram, Kerala, India, March 28, 1996, V.B. Hosagoudaar HCIO 42193.

According to the Beeli formula (3111.4234), this species stands distinct from other *Meliola* species reported on members of the family Lauraceae (Hansford, 1961). *Meliola cryptocariicola* Hosag. & Raghu and *M. patileana* Hosag. are known on this host from Karnataka and Maharashtra. The new species differs from both in having only alternate hyphopodia, straight to flexuous and acute mycelial setae (Hosagoudar, 1996).

This species is named in honour of Dr. P. Pushpangadan, Director of TBGRI who is devoted to developing the TBGRI Institution into a prestigious and internationally known Botanical Institute

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MELIOLACEAE OF KERALA, INDIA - III

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Abstract

This paper describes *Asteridiella julostylidis, Meliola chilocarpi, M. dorsteniae* and *M. linderae* Yamam. var. *microspora*, three new species and a variety of the Meliolaceae members collected in the state of Kerala.

Key words: Meliolaceae, new taxa, Kerala, India

1. ***Asteridiella julostylidis*** Hosagoudar et Abraham *sp. nov.* (Fig. 1)

Coloniae epiphyllae, raro amphigenae, tenues vel subdensae, ad 2 mm diam. Hyphae flexuosae vel leniter anfractuae, alternate, opposite vel irregulariter acuteque vel laxe ramosae, laxe vel dense reticulatae, cellulae 26-36 x 6-7.5 μm. Hyphopodia alternata, minus 1% opposita, antrorsa, subantrorsa vel recurva, 19-26.5 μm longa; cellula basali cylindracea vel cuneata, 5-12 μm longa; cellula apicali ovata, globosa, integra, angularia vel raro sublobata, 14-17 x 14-16 μm. Phialides numerosis in pars coloniis, alternatis vel oppositis, ampullaceus, 16-21.5 x 6-8 μm. Perithecia dispersa, ad 144 μm diam.; cellulae peritheciales conoideae, ad 11 μm longae; ascosporae oblongae vel cylindraceae, 4-septatae, leniter constrictae, 38-41 x 14-17 μm.

Colonies epiphyllous, rarely amphigenous, thin to subdense, up to 2 mm in diameter. Hyphae flexuous to slightly crooked, branching alternate, opposite to irregular at acute to wide angles, loosely to closely reticulate, cells 26-36 x 6-7.5 μm.

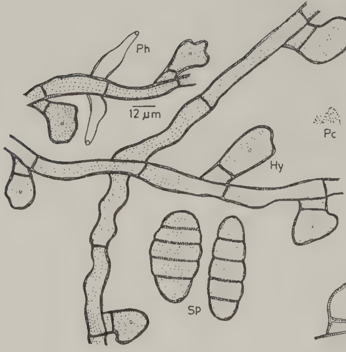
Ph
12 µm
Pc
Hy
Sp

Fig. 1. *Asteridiella julostylidis*

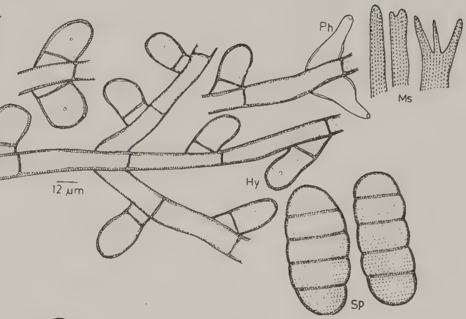
Ph
Ms
12 µm
Hy
Sp

Fig. 2. *Meliola chilocarpi*

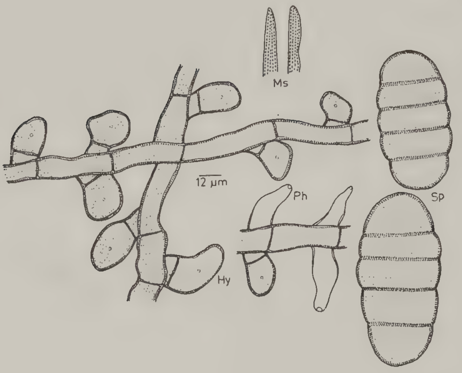
Ms
12 µm
Ph
Sp
Hy

Fig. 3. *Meliola dorsteniae*

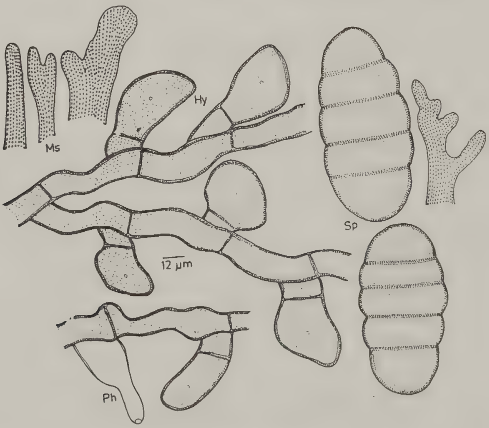
Hy
Ms
Sp
12 µm
Ph

Fig. 4. *Meliola linderae* var. *microspora*

Key to Abbreviations: Hy = Hyphopodia, Ms = Mycelial Setae, Pc = Perithecial cells, Ph = Phialides, Sp = Ascospores

Hyphopodia alternate, less than 1% opposite, antrorse, subantrorse to recurved, 19-26.5 μm long; stalk cells cylindrical to cuneate, 5-12 μm long; head cells ovate, globose, entire, angular to rarely sublobate, 14-17 x 14-16 μm. Phialides numerous in some colonies, alternate to opposite, ampulliform, 16-21.5 x 6-8 μm. Perithecia scattered up to 144 μm in diam.; perithecial cells conoid, up to 11 μm long, ascospores oblong to cylindrical, 4-septate, slightly constricted at the septa, 38-41 x 14-17 μm.

Holotype: On leaves of *Julostylis polyandra* Ravi & Anil (Malvceae), in the forest near Kombe, Meenmutty, Thiruvananthapuram, Kerala, India, March 9, 1996. V.B. Hosagoudar HCIO 42140.

Asteridiella pavoniae (Cif.) Hansf. known from San Domingo, is the only species of the *Asteridiella* reported on *Pavonia spicata* (Hansford, 1961). The new species differs from it in having only alternate (less than 1% opposite) hyphopodia; entire, angular to sublobate head cells of the hyphopodia.

2. ***Meliola chilocarpi*** Hosagoudar and Abraham *sp. nov.* (Fig. 2)

Coloniae amphigenae, plerumque epiphyllae, tenues vel subdensaee, ad 1 mm diam., raro confluentes. Hyphae plerumque rectae vel leniter flexuosae, plerumque opposite acuteque ramosae, laxe reticulatae, cellulae 14-24 x 7-8 μm. Hyphopodia alternata, ad 5% opposita, antrorsa vel subantrorsa, 14-19.5 μm longa; cellula basali cylindracea vel cuneata, 2.5-5 μm longa; cellula apicali ovata, globosa, integra, 12-14.5 x 9-12.5 μm.Phialides illis hyphopodiis commixtis, alternatis vel oppositis, ampullaceus, 19-24 x 7-9.5 μm. Setae myceliales paucae, juxta perithecia aggregatae, simplices, rectae, acutae ad apicem, ad 400 μm longae. Perithecia dispersa, ad 145 μm diam.; ascosporae cylindraceae, 4-septatae, constrictae, 43-46.5 x 14-17 μm.

Colonies amphigenous, mostly epiphyllous, thin to subdense, up to 1 mm in diameter, rarely confluent. Hyphae mostly straight to slightly flexuous, branching mostly opposite at acute angles, loosely reticulate, cells 14-24 x 7-8 μm. Hyphopodia alternate, about 5% opposite, antrorse to subantrorse, 14-19.5 μm long; stalk cells cylindrical to cuneate, 2.5-5 μm long; head cells ovate, globose, entire, 12-14.5 x 9-12.5 μm. Phialides mixed with hyphopodia, alternate to opposite, ampulliform 19-24 x 7-9.5 μm. Mycelial setae few, grouped around perithecia, simple, straight, acute at the tip, up to 400 μm long. Perithecia scattered up to 145 μm in diam. Ascospores cylindrical, 4-septate, constricted at the septa, 43-46.5 x 14-17 μm.

Holotype: On leaves of *Chilocarpus atrovirens* (G. Don) Blume (*Hunteria atrovirens* G. Don) (Apocynaceae), Athirumala, Neyyar Wildlife Sanctuary, Thiruvananthapuram, Kerala, India, March 26, 1996, V.B. Hosagoudar HCIO 42155.

This species can be compared with *Meliola guamensis* Sydow in having dentate and shortly furcate mycelial seteae (Hansford, 1961). However, the new species differs in having 5% opposite, subantrorse and smaller hyphopodia.

3. ***Meliola dorsteniae*** Hosagoudar et Abraham *sp. nov.* (Fig. 3)

Coloniae epiphyllae, minutae, densae, ad 1 mm diam., raro confluentes. Hyphae rectae vel subrectae, plerumque opposite acuteque vel laxe ramosae, laxe vel dense reticulatae, cellulae 14-31.5 x 6-7.5 μm. Hyphopodia alternata, ad 30% opposita, subantrorsa vel retrorsa, 12-14.5 μm longa; cellula basali cylindracea vel cuneata, 2.5-5 μm longa; cellula apicali ovata, globosa, recta vel curvula, integra, leniter attenuata et late rotundata ad apicem, 9-12.5 x 9-10 μm. Phialides illis hyphopodiis commixtis, alternatis vel oppositis, ampullaceus, 17-19.5 x 7-8 μm. Setae myceliales modice numerosae, simplices, rectae, acutae ad apicem, ad 310 μm longae. Perithecia dispersa, ad 170 μm diam.; ascosporae oblongae, 4-septatae, leniter constrictae, 40-42 x 16-18 μm.

Colonies epiphyllous, minute, dense, up to 1 mm in diameter, rarely confluent. Hyphae straight to substraight, branching mostly opposite at acute to wide angles, loosely to closely reticulate, cells 14-31.5 x 6-7.5 μm. Hyphopodia alternate, about 30% opposite, subantrorse to retrorse, 12-14.5 μm long; stalk cells cylindrical to cuneate, 2.5-5 μm long; head cells ovate, globose, straight to curved, entire, slightly attenuated but broadly rounded at the apex, 9-12.5 x 9-10 μm. Phialides mixed with hyphopodia, alternate to opposite, ampulliform, 17-19.5 x 7-8 μm. Mycelial setae moderately numerous, simple, straight, acute at the apex, up to 310 μm long. Perithecia scattered, up to 170 μm in diam.; ascospores oblong, 4-septate, slightly constricted, 40-42 x 16-18 μm.

Holotype: On leaves of *Dorstenia indica* Wight (Moraceae), Agarstiar Hill, Neyyar Wildlife Sanctuary, Thiruvananthapuram, Kerala, India, March 26, 1996, V.B. Hosagoudar HCIO 42188.

Meliola brinkii Hansf. and *M. chlorophorae* Hansf. are two species reported on the members of the family Moraceae as having alternate and opposite hyphopodia (Hansford, 1961). The new species differs from both in having simple and acute mycelial setae.

4. ***Meliola linderae*** Yaman. var. ***microspora*** Hosagoudar et Abraham *var. nov.* (Fig. 4)

Peraffinis *Meliola linderae* Yaman. et differt a var. *linderae* coloniis positus in maculis nigris et ascosporis brevibus.

Colonies hypophyllous, located on black spots, thin to subdense, up to 3 mm in diameter. Hyphae crooked, branching irregular at acute angles, loosely to closely reticulate, cells 19-24 x 5-7.5 μm. Hyphopodia alternate, antrorse, subantrorse, spreading to recurved, 24-29 μm long; stalk cells cylindrical to cuneate, 7-17 μm long; head cells ovate, globose, oblong, entire to angular and truncate at the apex, 12-17 x 12-14.5 μm. Phialides mixed with hyphopodia, alternate to opposite, ampulliform, 16-24 x 6-8 μm. Mycelial setae grouped around perithecia to scattered, simple straight, acute, obtuse to 2-3 times dentate at the tip, up to 936 μm long. Perithecia scattered, up to 144 μm in diam.; ascospores oblong to cylindrical, 4-septate, slightly constricted at the septa, 36-38.5 x 14-16 μm.

Holotype: On leaves of *Actinodaphne malabarica* Balakr. *(A. hookeri sensu* Bedd.) (Lauraceae), Meenmutty, Neyyar Wildlife Sanctuary, Thiruvananthapuram, Kerala, India, March 10, 1996. V.B. Hosagoudar HCIO 42164.

This collection is close to *Meliola linderae* Yamam. The new variety differs from var. *linderae* in having colonies located on the black spots and in having smaller ascospores.

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MELIOLACEAE OF KERALA, INDIA - IV

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Abstract

This paper gives an account of *Meliola actinodaphnecola, M. dimocarpi* and *M. strychnacearum*, three new species of the Meliolaceae collected in the state of Kerala.

Key words: Meliolaceae, new taxa, Kerala, India

1. ***Meliola actinodaphnecola*** Hosagoudar et Abraham *sp. nov.* (Fig. 1)

Coloniae amphigenae, plerumque hypophyllae, subdensae vel densae, ad 5 mm diam. Hyphae in folia superficies superiorae rectae et anfractuae in folia superficies inferiorae, opposite et irregulariter acuteque vel laxe ramosae, laxe vel dense reticulatae, cellulae 40-60 x 6-8 μm. Hyphopodia valde remotus posita, alternata, antrorsa vel retrorsa, recta vel variae curvula, 24-39 μm longa; cellula basali cylindracea vel cuneata, 4.5-17 μm longa; cellula apicali ovata, globosa, integra vel irregulariter angularia, 17-22 x 14-19.5 μm. Phialides illis hyphopodiis commixta, alternata vel opposita, ampullacea, 17-22 x 14-19.5 μm. Setae myceliales dispersae vel juxta perithecia aggregatae, simplices, plerumque rectae, raro flexuosae vel curvulae ad portionio supernae, acutae ad apicem, setae ambiens perithecia parvulae et dentatae vel furcatae, ad apicem, ad 880 μm longae. Perithecia dispersa, ad 206 μm diam.; ascosporae ellipsoideae vel leniter fusiformae, 4-septatae, leniter constrictae, 58-61 x 21-24 μm.

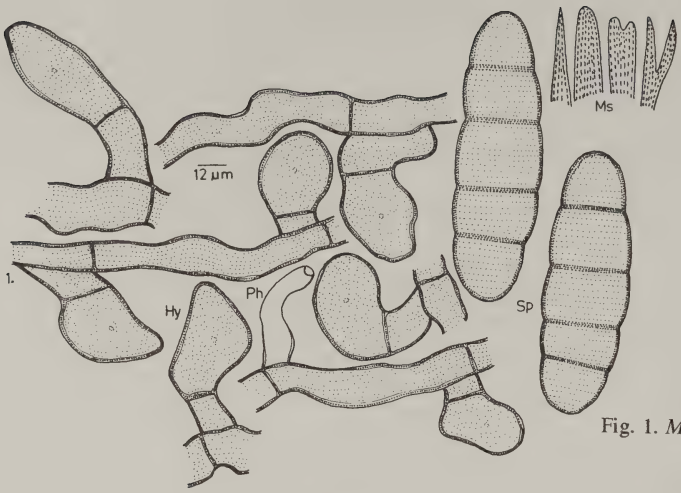
1.
12 µm
Ms
Ph
Hy
Sp

Fig. 1. *Meliola actinodaphnecola*

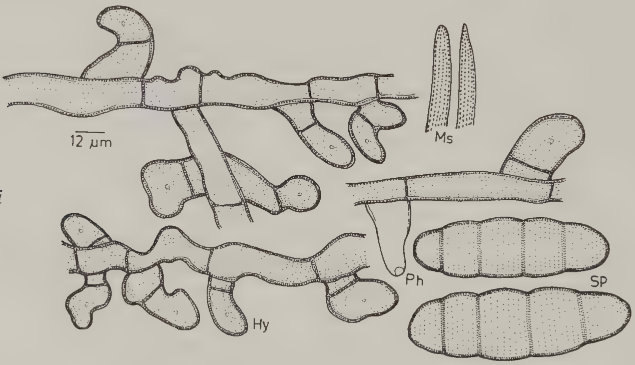
12 µm
Ms
Ph
Sp
Hy

Fig. 2. *Meliola dimocarpi*

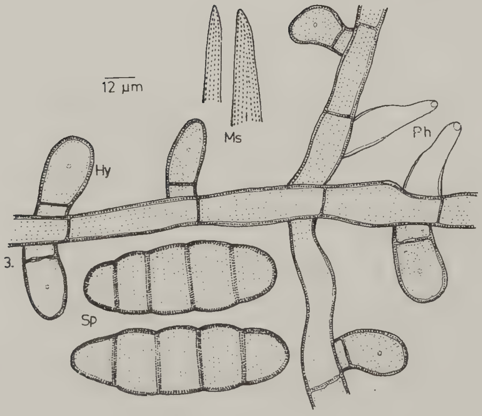
12 µm
Ms
Ph
Hy
3.
Sp

Fig. 3. *Meliola strychnacearum*

Abbreviations used: Hy = Hyphopodia, Ms = Mycelial setae,
Ph = Phialides, Sp = Ascospores.

Colonies amphigenous, mostly hypophyllous, subdense to dense up to 5 mm in diameter. Hyphae on the upper surface straight, crooked on the lower surface, branching opposite to irregular at acute to wide angles, loosely to closely reticulate, cells 40-60 x 6-8 μm. Hyphopodia very sparsely placed, alternate, antrorse to retrorse, straight to variously curved, 24-39 μm long; stalk cells cylindrical to cuneate, 4.5-17 μm long; head cells ovate, globose, entire to irregularly angulose, 17-22 x 14-19.5 μm. Phialides mixed with hyphopodia, alternate to opposite, ampulliform, 17-22 x 14-19.5 μm. Mycelial setae scattered to grouped around perithecia, simple, mostly straight, rarely flexuous to curved at the penultimate end, acute at the tip, setae around perithecia smaller, dentate to furcate at the tip, up to 880 μm long. Perithecia scattered, up to 206 μm in diam.; ascospores ellipsoidal to slightly fusiform, 4-septate, slightly constricted at the septa, 58-61 x 21-24 μm.

Holotype: On leaves of *Actinodaphne malabarica* Balakr. (Lauraceae), in the forest near Kombe, Meenmutty, Neyyar Wildlife Sanctuary, Thiruvananthapuram, Kerala, India, April 11, 1996, V.B. Hosagoudar HCIO 42180.

The new species can be compared with *Meliola actinodaphnes* Hino & Katumoto (*actinodaphnis*), reported on this host genus from Japan (Hino & Katumoto, 1957). This is a later homonym of *M. actinodaphnes* Hansf. (Hansford, 1961). The new species differs from other *Meliola* species known on the members of the family Lauraceae in having very sparsely located hyphopodia; straight, flexuous to curved mycelial setae and smaller, dentate to furcate setae around perithecia.

2. ***Meliola dimocarpi*** Hosagoudar et Abraham *sp. nov.* (Fig. 2)

Coloniae hypophyllae, subdensae, ad 5 mm diam. Hyphae anfractuae, irregulariter acuteque vel laxe ramosae, laxe vel densel reticulatae, cellulae 26-29 x 7-8 μm. Hyphopodia alternata, ad 3% opposita, antrorsa, subantrorsa, retrorsa, recta vel curvula, 17-22 μm longa; cellula basali cylindracea vel cuneata, 7-8 μm longa; cellula apicali ovata, globosa, integra vel angularia 9-14.5 x 9-12 μm. Phialides illis hyphopodiis commixtis, dispersum, ampullaceus, 24-30 x 7-9.5 μm. Setae myceliales paucae, plerumque juxta perithecia aggregatae, simplices, rectae, acutae ad apicem, ad 267 μm longae. Perithecia dispersa, ad 120 μm diam.; ascosporae cylindraceae, 4-septatae, leniter constrictae, 48-50 x 14-17 μm.

Colonies hypophyllous, subdense, up to 5 mm in diameter. Hyphae crooked, branching irregular at acute to wide angles, loosely to closely reticulate, cells 26-29 x 7-8 μm. Hyphopodia alternate, about 3% opposite, antrorse, subantrorse, retrorse, straight to curved, 17-22 μm long; stalk cells cylindrical to cuneate, 7-8 μm long; head cells ovate, globose, entire to angular, 9-14.5 x 9-12 μm. Phialides mixed with hyphopodia, scattered, ampulliform, 24-30 x 7-9.5 μm. Mycelial setae few, mostly grouped around perithecia, simple, straight, acute at the apex, up to 267 μm long. Perithecia scattered, up to 120 μm in diam.; ascospores cylindrical, 4-septate, slightly constricted at the septa, 48-50 x 14-17 μm.

Holotype: On leaves of *Dimocarpus longan* L. (*Nephelium longan* (Lam.) Cane) (Sapindaceae), Athirumala forest, Neyyar Wildlife Sanctuary, Thiruvananthapuram, Kerala, India, March 27, 1996, V.B. Hosagoudar HCIO 42186.

Meliola capensis (Kalch. & Cooke) Theiss, var. *malayensis* Hansf. and *M. commixta* Sydow have been reported on this host (Hansford, 1961); Hosagoudar, 1996). The new species differs from *M. capensis* in lacking regulary opposite hyphopodia with conoid head cells. It also differs from *M. commixta* in having longer hyphopodia and larger ascospores.

3. Meliola strychnacearum Hosagoudar et Abraham *sp. nov.* (Fig. 3)

Coloniae hypophyllae, tenues vel subdensae, ad 5 mm diam. Hyphae rectae, plerumque opposite laxe ramosae, laxe vel dense reticulatae, cellulae 24-26.5 x 7-8 μm. Hyphopodia alternata, ad 10% opposita, antrorsa vel subantrorsa, plerumque directus ad hyphae, 12-17 μm longae; cellula basali plerumque cylindracea, 2.5-5 μm longa; cellula apicali ovata, plerumque recta, raro curvula, integra, 9-13 x 8-12 μm. Phialides illis hyphopodiis commixtis, alternatis vel oppositis, conoideus vel ampullaceus, 19-24 x 9-10 μm. Setae myceliales dispersae, simplices, rectae, acutae vel subacutae ad apicem, ad 570 μm longae. Perithecia dispersa, ad 195 μm diam.; ascosporae cylindraceae, 4-septatae, constrictae, 36-41.5 (-48.5) x 12-17 μm.

Colonies hypophyllous, thin to subdense, up to 5 mm in diameter. Hyphae straight, branching mostly opposite at wide angles, loosely to closely reticulate, cells 24-26.5 x 7-8 μm. Hyphopodia alternate, about 10% opposite, antrorse to subantrorse, mostly perpendicular to the hyphae, 12-17 μm long; stalk cells mostly cylindrical, 2.5-5 μm long; head cells ovate, mostly straight, rarely slightly curved, entire, 9-13 x 8-12 μm. Phialides mixed with hyphopodia, alternate to opposite, conoid to ampulliform, 19-24 x 9-10 μm. Mycelial setae scattered, simple straight, acute to subacute at the tip, up to 570 μm long. Perithecia scattered, up to 195 μm in diam.; ascospores cylindrical, 4-septate, constricted at the septa, 36-41.5 (-48.5) x 12-17 μm.

Holotype: On leaves of *Strychnos sp.* (Strychnaceae), Pongalapara, Athirumala, Neyyar Wildlife Sanctuary, Thiruvananthapuram, Kerala, India, March 26, 1996, V.B. Hosagoudar HCIO 42194.

Meliola fagraceae Sydow is comparable to the new species in having 10% opposite hyphopodia (Hansford, 1961). However, the new species differs from it in having straight hyphae and shorter hyphopodia with entire head cells.

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We gratefully acknowledge the Forest Department, Government of Kerala for sponsoring this work. We are thankful to Dr. P. Pushpangadan, Director and Dr. N. Mohanan, Scientist, Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram for encouragement and identification of the host plants, respectively. We thank Dr. J.L. Crane for his pre-submission review.

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TWO NARROW-SPORED INOCYBES

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SUMMARY

Inocybe marmoripes Atkinson, a little known species, is redescribed. A new species, *Inocybe angustispora*, is described from New York.

INTRODUCTION

Inocybe marmoripes was described by George Francis Atkinson (1918) from a collection made in Ithaca, New York. The only other reference to this taxon to date, is that provided by C. H. Kauffman in the *Inocybe* section of *North American Flora* (1924). We are unaware of any additional collections or reports of this unusual species. A collection made by Arleen Bessette (Alan Bessette 10705) in the Rome Sand Plains, Rome, New York on October 15, 1996 was found to have unusually narrow spores and thought to perhaps be *I. marmoripes*. However an inspection of the holotype of *I. marmoripes* revealed that the collection was not that species and possessed even narrower spores. Therefore a new species is described. *Inocybe marmoripes* is also redescribed in order to provide additional information and illustrations of this apparently rare species.

MATERIALS AND METHODS

Color terms and designations used in the following descriptions are cited from Maerz & Paul (1950), e.g., M&P 15C9, or from the ISCC-NBS system (Kelly & Judd, 1955), e.g., 75 deep yellowish Brown. Otherwise color names are an approximation of general color hues. Microscopic descriptions were made from sections revived and mounted in 3% KOH. Line drawings were made with the aid of a drawing tube.

DESCRIPTIONS OF TAXA

Inocybe marmoripes Atkinson, American Journal of Botany 5: 213. 1918. Figs. 1-3

The original unpublished english description by Atkinson, which Cornell University provided as an accompaniment with the type material, follows:

"Ground, woods west of Lake near Glenwood, July 30, 1917. L.B.Walker.

Plants solitary, or clustered. Three joined at the base. One very young one, small with a larger one. The larger plant not fully expanded but numerous spores are matured. Plant 5 cm high, pileus now 2 cm broad, stem 6 mm stout.

Pileus convex, ochraceous tawny, fibrillose scaly, more prominent over the center where there are some conical, erect scales.

Gills adnate, olive, edge lighter colored. Cystidia none on sides of gills. Edge of gills eroded. Crowded with more or less flexuous cylindrical-clavate sterile cells. Basidia 4-spored. Spores narrow, elongate, subellipsoid, inequilateral to evened in profile, smooth, 8-13 x 3.4-4.5 µ.

Stems even or slightly enlarged at the base, ochraceous tawny, then as it elongates the ochraceous tawny fibrillose covering breaking into numerous scales forming irregular concentric rings or coarse ochraceous tawny reticulations showing the whitish stem tissue between, near the upper part of the stem and universal veil terminating with a slight very evanescent annulus. The stem tissue is whitish or with a tinge of yellow, solid or stuffed.

Odor and taste not marked.

Related to *I. unicolor*, but plants stouter, spores narrower, and stem surface different."

The pileus surface on the dried type material, which consists of a half basidioma, is completely fibrillose-scaly with no smooth or rimose areas. The ochraceous tawny color of the pileus is M&P 13G9 or approximately 74 strong yellowish Brown and does not contain any grayish tones. The stipe is as described above with the ochraceous patches extending to the base.

Microscopic features: spores: 27 measured, 8-13 x 4-5.5 µm, average size 10.5 x 4.6 µm, average Q = 2.28, smooth, inequilateral, oblong, subcylindric, pale brownish ochraceous in 3% KOH; **pleurocystidia:** absent; **cheilocystidia:** abundant clusters of thin walled, colorless cells, flexuous cylindrical, subclavate, 30-65 x 6-12 µm; **basidia:** 32-40 x 9-11 µm, clavate, 4 sterigmate; **caulocystidia:** at the stipe apex, thin walled, clavate to broadly fusiform, 25-50 x 15-20 µm, in clusters with cystidioid hairs; the ochraceous fibrillose patches on the stipe consist of tightly interwoven hyphae 4-8 µm wide; **pileipellis:** slightly interwoven to subparallel septate hyphae, radially oriented, 6-14 µm wide, some with encrusting brown pigment, fibrillose scales with clustered repent to suberect subcylindric to subclavate end cells. Laticiferous hyphae present in the stipe and pileus tissue. Clamp connections present on most septa throughout the basidiocarp.

MATERIAL EXAMINED: NEW YORK: Tompkins Co.; Glenwood, Atkinson 24275, (Holotype CUP).

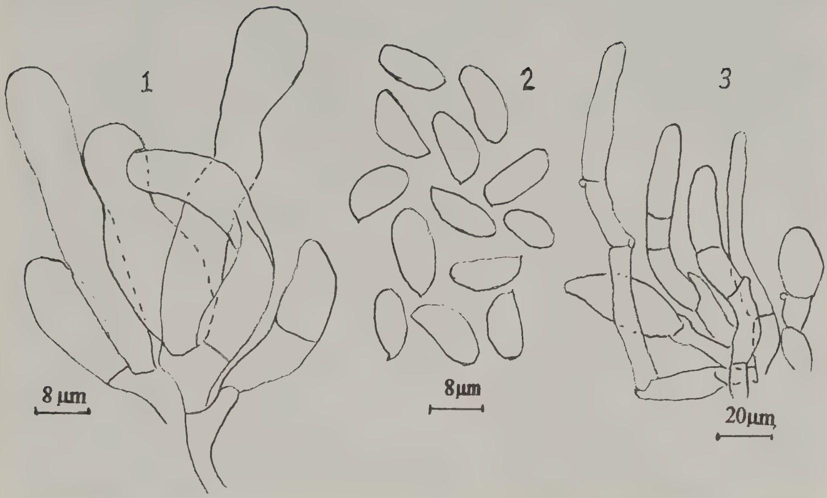

Fig. 1-3. *Inocybe marmoripes* (Atk. 24275). 1. Cheilocystidia. 2. Spores. 3. Caulocystidia at apex of stipe.

Inocybe angustispora Bessette & Fatto sp. nov. Figs. 4-7

Pileus 1-5 cm latus, convexus, tum late convexus ad paene planum, non umbonatus; in superficie siccus, sericeo-glaber ad marginem appresso-fibrillosum; ochraceo-fulvus usque ad ochraceo-brunneum vel olivaceo-brunneum cum tinctis obscurioribus typice in disco; caro albida usque ad pallido-luteam. Odor et sapor indistincti. Lamellae adnatae cum dente decurrente vel sinuato, subdistantes, primo pallido-luteae, tum sordide ochraceo-fuscae. Stipes 2-5 cm longus, 1.5-6 mm crassus, fibrillosus in longitudine, primo pallido-luteus, tum sordide ochraceo-fulvus; velum partiale sparsum, luteum, evanescens. Sporae depositae fuscae sordide. Sporae 9-14 x 3.2-4.4 µm, elongato-subcylindricae usque ad subfusifoideum; pleurocystidia absentia; cheilocystidia 11-16 µm, clavata usque ad obovoidea vel subellipsoidea.

Holotypus legit A. E. Bessette 10705, a A. R. Bessette inventus, Rome Sand Plains, Oneida County, NY, USA. 15 October 1996. Conservatus in herbario Musei Novi Eboraci (NYS).

Pileus: 1-5 cm wide, convex, becoming broadly convex to nearly plane, not umbonate, sometimes shallowly depressed on the disc, margin incurved at first, becoming decurved, even, not rimulose; surface dry, sericeous-smooth to appressed-fibrillose marginally, ochraceous tawny to ochraceous brown or olive-brown, typically with grayish brown to fuscous tints over the disc; context very thin, whitish to pale yellow, unchanging when exposed; odor and taste not distinctive. **Lamellae:** adnate with decurrent tooth to sinuate,

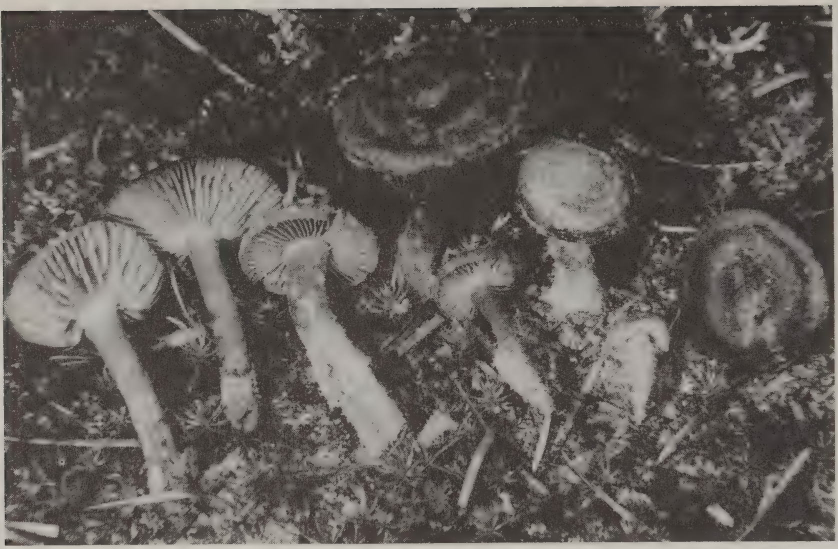

Fig. 4. Basidiocarps of *Inocybe angustispora* (Bessette 10705) x 1.

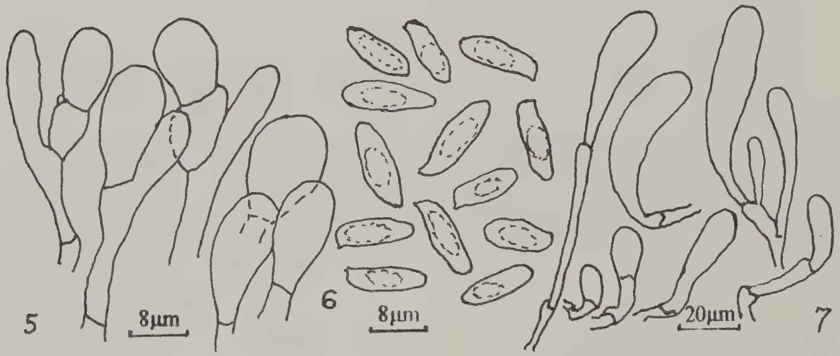

Fig. 5-7. *Inocybe angustispora* (Bessette 10705). 5. Cheilocystidia. 6. Spores. 7. Caulocystidia at apex of stipe.

seceding in age, narrow, becoming ventricose, subdistant, pale yellow to greenish yellow at first, becoming dull yellow and finally dull yellowish brown, drying rusty brown, with 3-4 tiers of attenuate lamellulae, edges pallid-fimbriate when young. **Stipe:** 2-5 cm long, 1.5-6 mm thick, nearly equal down to a slightly expanded base, dry, solid at first, becoming hollow at maturity, longitudinally fibrillose, pale yellow at first, becoming ochraceous to dull ochraceous tawny; partial veil sparse, yellowish, evanescent.

Macrochemical tests: pileipellis stains violaceous fuscous then quickly mahogany-red with the application of KOH or NH_4OH, and is negative with $FeSO_4$; context stains purplish then dull brown with the application of KOH or NH_4OH, and slowly weakly olive with $FeSO_4$. Dried tissue sections of the pileipellis and lamellae conspicuously release a reddish pigment in 3% KOH.

Spores: dull brown in deposit, 60 measured on 3 basidiomata, 9-14 x 3.2-4.4 µm, average size 11.4 x 3.6 µm, average Q=3.17, smooth, elongate-subcylindric to subfusoid, often with conspicuous suprahilar depression reminiscent of *Boletus* spores, ochraceous to brownish ochraceous in Melzers and 3% KOH, guttulate in KOH; **pleurocystidia:** absent; **cheilocystidia:** clusters of thin walled, colorless cells, 11-16 x 6-11 µm, clavate to obovoid or subellipsoid, easily seen on younger specimens, scarcer when older; **basidia:** 22-32 x 6.5-9 µm, narrowly clavate, with four sterigmata; **lamellar trama:** parallel, cells 4-15 µm wide; **caulocystidia:** at stipe apex, thin walled, cylindrical to clavate, 20-64 x 6-14 µm, scarce to scattered clusters; lower stipe with abundant superficial hyphae, described by Kuyper (1986) as caulocystidioid hairs, 5-18 µm wide, with cylindrical to clavate terminal cells, without caulocystidia; **pileipellis:** an interwoven cutis with pale brown cylindrical hyphae 5-18 µm thick; **pileal trama:** with refractive laticiferous hyphae. Clamp connections present on most septa.

Fruiting: scattered or in groups on sand dunes or sandy soil under pitch pine (*Pinus rigida* Mill.) and several species of oak, especially red oak (*Quercus rubra* L.); September to November; fairly common in the type locality.

MATERIAL EXAMINED: NEW YORK: Oneida Co.: Rome Sand Plains, 15 Oct 1996, Bessette 10705, (Holotype NYS).

Comments: While the pileus colors of fresh specimens vary somewhat in their shades of brown, upon drying they all assume the same tone as represented by M&P 13G9 or approximately 74 strong yellowish Brown. Because of the absence of pleurocystidia, the smooth spores, and cheilocystidia originating as hymenial elements, *Inocybe angustispora* is a member of subgenus *Inosperma* as defined by Kuyper. The determination of this fruiting body as an *Inocybe* is not obvious since its macroscopic appearance lacks the typical conic to umbonate pileus, a radially rimose or obviously squamulose cuticle, and any distinctive odor. The microscopic characters, while very distinctive, are somewhat unusual for the genus. The spores are narrower and the cheilocystidia are shorter and less noticeable than for any other species described in Kuyper's monograph. Once recognized, all of these characteristics are strongly diagnostic and provide for an easy determination of the genus and species.

Although *Inocybe angustispora* is similar to *I. marmoripes*, they differ in several significant ways. *Inocybe angustispora* has a pileus that is sericeous-smooth to appressed-fibrillose marginally, lamellae that are dull yellowish brown at maturity, and a longitudinally fibrillose stipe. *Inocybe marmoripes* has a pileus that is fibrillose-scaly becoming prominently so over the disc, lamellae that are olive with paler edges, and a stipitipellis that breaks into numerous scales, forming irregular concentric rings or coarse reticulation with exposed whitish tissue. Microscopically, *I. angustispora* has guttulate, elongate-subcylindric to subfusoid spores that measure 9-14 x 3.2-4.4 µm, (Q = 3.17), and small, clavate to obovoid or subellipsoid cheilocystidia that measure 11-16 x 6-11 µm. *Inocybe marmoripes* has oblong to subcylindric spores that lack guttules and measure 8-13 x 4-4.5 µm, (Q = 2.28), and abundant clusters of subclavate cheilocystidia that measure 30-65 x 6-12 µm.

ACKNOWLEDGMENTS

We are grateful to Dr. Timothy J. Baroni of the State University College at Cortland, for reviewing this paper and providing helpful comments, Alice Janick for providing the latin description, and Susan C. Gruff at Cornell University Herbarium for providing the type material and documents.

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MYCOTAXON

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RIMELIA PONTAGROSSENSIS, A NEW SPECIES IN THE PARMELIACEAE SENSU STRICTO (LICHENIZED ASCOMYCOTINA) FROM BRAZIL

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ABSTRACT: *Rimelia pontagrossensis* Eliasaro & Adler is described as a new species in the Parmeliaceae sensu stricto from Brazil. It is similar to *Rimelia reticulata* (Tayl.) Hale & Fletcher, differing mainly from this species by the presence of medullary lichexanthone. It is so far only known from the Segundo Planalto in the State of Paraná.

The present study is based on specimens collected by the first author. The abbreviations for names of herbaria correspond to the "Index Herbariorum" (Holmegren et. al., 1990). Lichen substances were identified by TLC (Elix, Johnston & Parker, 1987) and by comparison with authentic samples.

Rimelia pontagrossensis Eliasaro & Adler sp. nov. **Fig. 1**

Species cum thallo simile *Rimelia reticulata* sed ab haec specie lichexanthono medulli continente differt.
Typus: **Brasil. Paraná**. Ponta Grossa, Buraco do Padre, 25°07'S, 50°15' W, corticolous, 27 January 1996, S. Eliasaro 1621 (UPCB 28650-holotype; BAFC 37879 , CANB -isotypes).

(*) To ask offprints, write to the second author.

Thallus corticolous, grey to greenish grey, loosely attached to the substrate, up to 10 cm across, sorediate, soralia mainly marginal, capitate or subcapitate, occasionally submarginal and punctiform. Lobes subirregular, 5-10 mm wide, with ciliate margins; cilia black, simple, up to 1.5 mm long or frequently bi- tri- or tetrafurcate, occasionally pentafurcate, with a typical, variable, branching pattern (Fig. 1 B and Fig. 2). Upper surface reticulately maculate and cracked. Medulla white. Lower surface black, moderately rhizinate, with a broad, brown or mottled, bare marginal zone at the lobe apices; rhizines black, simple or commonly with the same branching pattern of the cilia, sometimes very long (up to 2.5 mm). Apothecia not seen. Pycnidia immersed, mostly grouped in submarginal areas, immature or old, empty; conidia not seen.

Chemistry: Upper cortex K+ yellow (atranorin, major). Medulla K+ yellow turning red (salazinic acid, major), UV+ bright yellow (lichexanthone, major).

The specific epithet refers to the locality where the type material was collected.

Additional specimen examined: BRASIL. Paraná. Tibagí, Guartelá (24°32' S, 50°19' W), corticolous, 22 January 1996, S. Eliasaro 1497 (UPCB 28670).

Remarks: *Rimelia pontagrossensis* is a sorediate species, morphologically very similar to *R. reticulata* (Tayl.) Hale & Fletcher (Hale et al., 1990), except for the peculiar branching pattern of the cilia and rhizines. It also differs in the medullary chemistry: *R. pontagrossensis* has lichexanthone in addition to salazinic acid. Two other species of *Rimelia* have lichexanthone in the medulla: the isidiate *R. bonplandii* Mata (Mata García, 1994) with medullary norlobaridone and the sorediate *R. diffractaica* (Essl.) Hale & Fletcher with medullary diffractaic acid (Hale et al., 1990).

Rimelia pontagrossensis is so far only known from the "Segundo Planalto" in the State of Paraná.

ACKNOWLEDGEMENTS: the authors thank Prof. John A. Elix for suggestions to the manuscript; Prof. Nasser K. Hammad for checking the Latin diagnosis; the Consejo Nacional the Investigaciones Científicas y Técnicas (Argentina) and the Universidad de Buenos Aires (Argentina) for financial support.

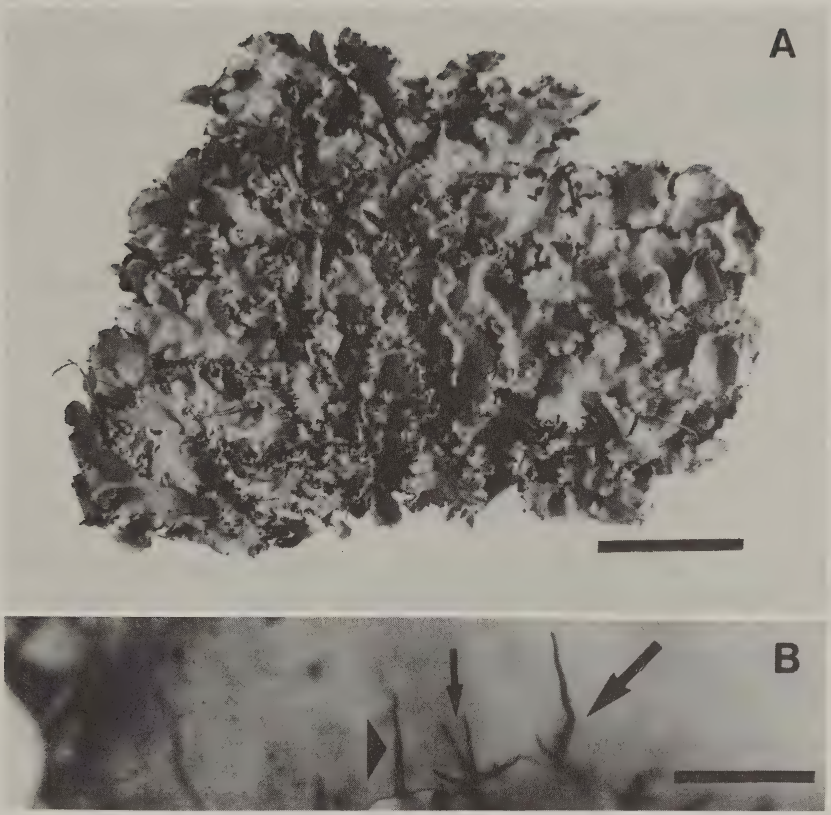

Fig. 1. *Rimelia pontagrossensis* : A, part of holotype, scale = 2 cm; B, detail of cilia: simple (left arrow), tetrafurcate (central arrow) and bifurcate (right arrow), scale = 0.5 mm.

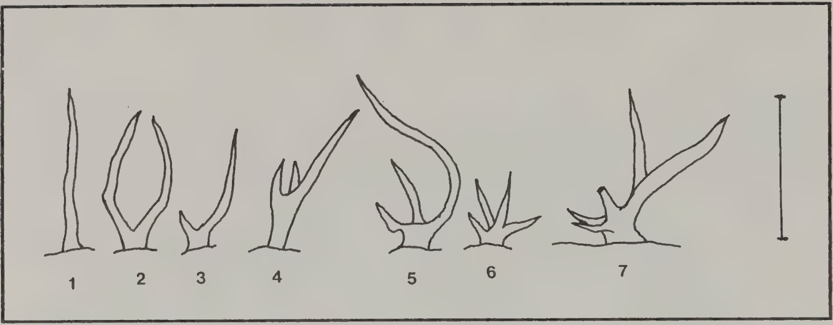

Fig. 2. Main types of cilia found in *Rimelia pontagrossensis* (schematic): simple (1); bifurcate (2, 3); trifurcate (4, 5); tetrafurcate (6); pentafurcate (7). Scale = 0.5 mm.

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MYCOTAXON

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TWO NEW SPECIES OF PARMOTREMA (PARMELIACEAE SENSU STRICTO, LICHENIZED ASCOMYCOTINA) FROM ARGENTINA

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ABSTRACT: *Parmotrema alidactylatum* Estrabou & Adler and *P. sorediоaliphaticum* Estrabou & Adler are described as new species in the Parmeliaceae sensu stricto. The former is morphologically very similar to *P. tsavoense* Krog & Swinscow (an African endemic) differing mainly in its medullary chemistry, while the latter is the sorediate-dactylate morph of *P. alidactylatum*. Both new species are so far only known from the type locality in Argentina.

The present study is based on specimens collected by the first author at Cerro Colorado, an ecologically peculiar area of Northern Córdoba Province (Argentina). It is a locality with a group of low mountains, up to 800 m.s.l., and is a semiarid region with an average annual precipitation about 600 mm, concentrated between October and April, and a mean annual temperature of 18° C.

The abbreviations for names of herbaria correspond to the "Index Herbariorum" (Holmgren et al., 1990). Lichen substances were identified by TLC (Elix, Johnston & Parker, 1987) and by comparison with authentic samples.

Parmotrema alidactylatum Estrabou & Adler sp. nov. Fig. 1

Species cum thallo simile *Parmotrema tsavoense* sed ab haec specie atranorino medulloso et acidi aliphaticii medullosis continente differt.
Typus: ARGENTINA. Córdoba. Departamento Sobremonte, Cerro Colorado, 30°08' S, 64°54' W, on granite, March 1995, Estrabou (BAFC 37877-holotype; BM, CANB, H, O, S, TUR, Estrabou Herbarium 648-isotypes).

The specific epithet refers to the presence of aliphatic acids in the medulla and to the dactylate upper surface.

Thallus foliose, saxicolous, pale grey, loosely apressed, tightly attached to the substrate, up to 10 cm across. Lobes subirregular to rounded, crenate to incised, eciliate, 2.5-5 mm broad. Upper surface emaculate, plane to undulate, folded at the centre, densely dactylate, dactyls closed, generally smooth and stiff but occasionally rough and fragile, not sorediate,

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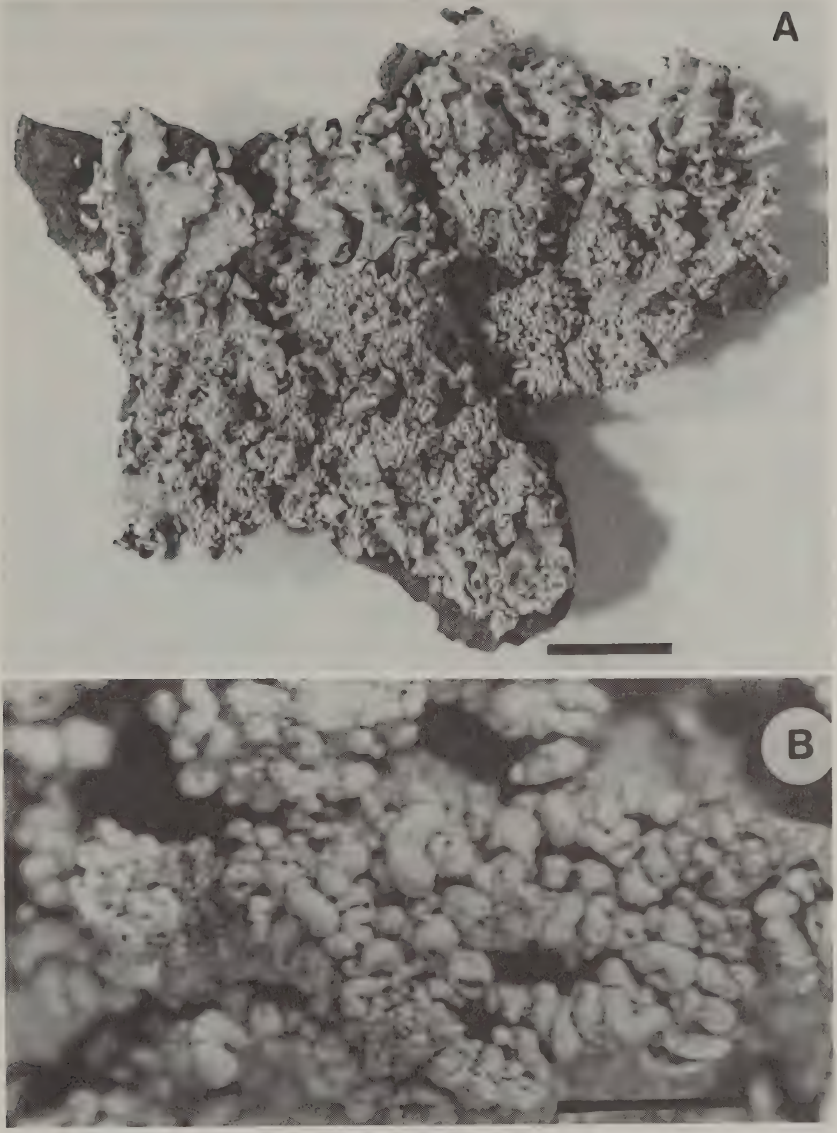
Fig. 1. *Parmotrema alidactylatum*. A, part of holotype, scale = 1 cm; B, detail of closed laminal dactyls, scale = 0.5 mm.


A
B

subspherical, subcrescent (Fig. 1B) to claviform. Medulla white. Lower surface black, with a broad, brown to ivory or mottled, naked marginal zone below the apices, rhizines simple, black, short, grouped in patches. Apothecia and pycnidia unknown.
Chemistry: Upper cortex K+ yellow (atranorin, major), medulla K- to K+ pale yellow (unidentified fatty acids, major, and atranorin, minor to trace).

Additional specimens examined: ARGENTINA. Córdoba Province. Departamento Sobremonte, Cerro Colorado, on granite, March 1995, Estrabou (Estrabou Herbarium 645, 646, 916, 917, 1308).

Remarks: *P. alidactylatum* resembles *P. tsavoense* (Krog & Swinscow, 1981, 1983; O-isotype!) in its saxicolous habitat, eciliate lobes, upper surface with closed dactyls, and black, sparsely rhizinate lower surface with simple, short rhizines, but differs from the latter in medullary chemistry. Thus unidentified fatty acids plus minor quantities of atranorin are present in *P. alidactylatum* instead of the physodic and oxyphysodic acids present in *P. tsavoense*.

So far *P. alidactylatum* is only known from the type locality in Argentina.

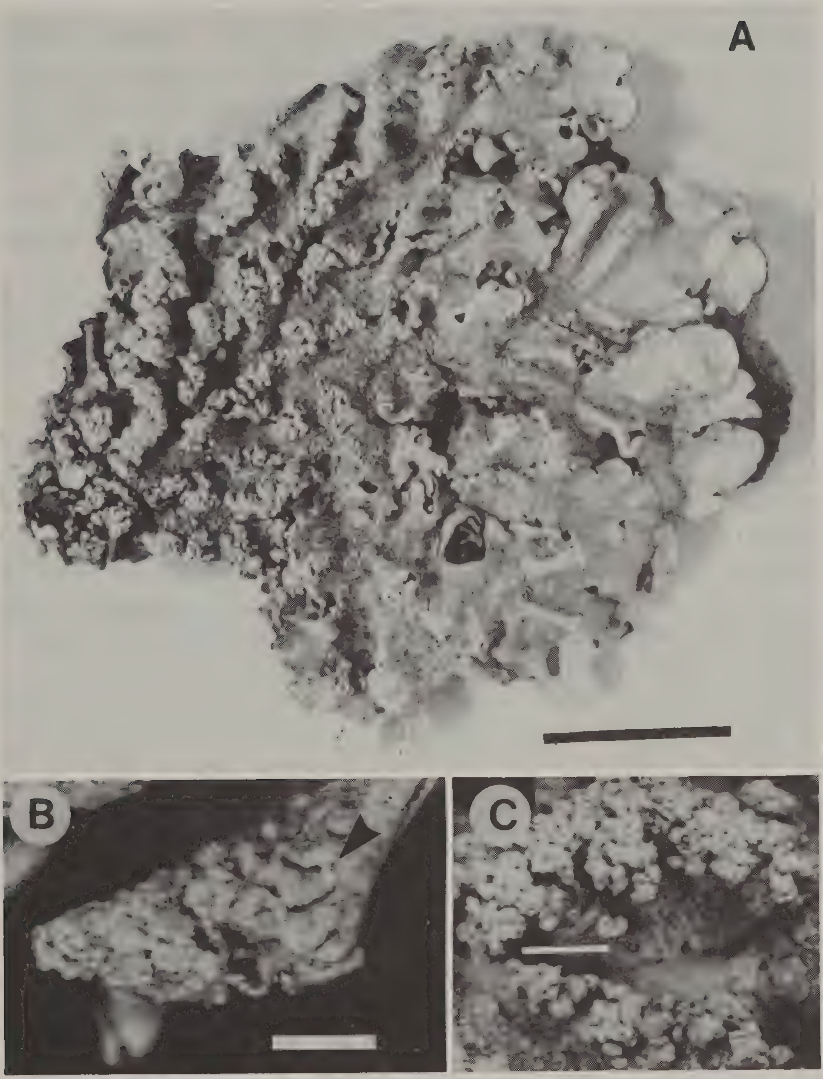
Parmotrema sorediolaliphaticum Estrabou & Adler sp. nov.

Fig. 2

Species cum thallo simile *Parmotrema alidactylatum* sed ab haec specie dactyli sorediatis differt.
Typus: ARGENTINA. Córdoba. Departamento Sobremonte, Cerro Colorado, 30°08' S, 63°54' W, on rock, November 1996, Estrabou (BAFC 37878-holotype, Estrabou Herbarium 1500-isotype).

The specific epithet refers to the sorediate dactyls and the medullary aliphatic acids.

Fig. 2. *Parmotrema soredioaliphaticum*. A, part of holotype, scale=1 cm; B, detail of laminal, open and finely sorediate dactyls (arrow), scale=0.5 mm; C, detail of sorediate dactyls, scale=0.5 mm.


A
B
C

Thallus foliose, saxicolous, pale grey, loosely apressed, tightly attached to the substrate, up to 10 cm across. Lobes subirregular to rounded, crenate to incised, eciliate, 2.5-5 mm wide. Upper surface emaculate, plane to undulate, folded at the centre, dactylate, dactyls at first small and closed, later becoming open and finely sorediate (Fig. 2B), eventually forming masses of soredia (Fig. 2C). Medulla white. Lower surface black, with a broad, brown to ivory or mottled, naked marginal zone below the apices, rhizines simple, black, short, grouped in patches. Apothecia and pycnidia not seen.

Chemistry: Upper cortex K+ yellow (atranorin, major); medulla K- to K+ pale yellow (unidentified fatty acids, major, and atranorin, minor to trace).

Remarks: *Parmotrema sorediοaliphaticum* is a morph of *P. alidactylatum* with sorediate dactyls, and is only known from the type locality.

ACKNOWLEDGEMENTS: the authors thank Herbarium O for loan of type material; Prof. John A. Elix for revision of the manuscript; Prof. Nasser K. Hammad for checking the Latin diagnoses; Ing. Agr. D. Reynoso for assistance in field work; the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET, Argentina), the Universidad de Buenos Aires and the Secretaría de Ciencia y Técnica of the Universidad de Córdoba, for financial support.

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PLEUROTUS FUSCOSQUAMULOSUS - A NEW SPECIES OF *PLEUROTUS* SUBGENUS *COREMIOPLEUROTUS* FROM SOUTH AFRICA

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ABSTRACT

Pleurotus fuscosquamulosus sp. nov. is described from South Africa. This taxon belongs in *Pleurotus* subgenus *Coremiopleurotus*, members of which produce an *Antromycopsis* state. In addition to a description of the wild basidiomes an account is also given of basidiomes produced in culture. Relationships of our new species are discussed. Finally an appendix is included with the results of compatibility studies between *P. fuscosquamulosus*, *P. cystidiosus* and *P. smithii.*

INTRODUCTION

During a visit to Trimpark, Pretoria in February 1993, in the company of Magda Nel, an unusual species of *Pleurotus* (Fr.) Kummer was collected, fruiting on both trunk and roots of a single tree of *Populus alba* L. Subsequently a further gathering of this fungus was made by M. Nel from Vaalwater, in January 1995, again fruiting on both the trunk and roots of a single tree, but on this occasion with *Combretum molle* R.Br. ex G.Don. as host.

Judged from experience of European species of *Pleurotus*, such coincident fruiting on both the trunk and roots of a single infected tree would seem to be extremely unusual. Yet this noteworthy phenomenon was exhibited by both South African examples of our new species.

Collections from South Africa are of a robust species with basidiomes up to 140mm diam., and this is further recognised by dimidiate or flabellate, buff coloured pilei, flecked with minute granular darker brown scales, appearing as if sprinkled with soot-like particles. These minute flecks are found chiefly towards the pileal attachment, but may be uniformly distributed over the entire surface. Towards the attachment there may also be larger, darker brown, spot-like, adpressed scales. Lamellae are creamy white, up to 10 mm deep, and either horizontal or subdecurrent, running down the short stipe in rudimentary lines or forming a reticulum, which may be blackish. In basidiomes emergent from knot holes on the trunks of infected trees, a stipe is often lacking, or very reduced and lateral, but basidiomes growing from roots may be centrally or laterally stipitate with a very short and stout stipe, up to 30 mm high, and to 25 mm wide - sometimes broader than it is long. The colour varies from whitish, to greyish beneath the lamellae or to blackish. However, final determination must rest on a study of the microscopic characters as outlined in the formal description which follows.

The South African collections show strong affinities with other members of *Pleurotus* subgenus *Coremiopleurotus* such as *P. cystidiosus* O.K.Miller, *P. smithii* Guzman and *P. abalonus* Han, Chen & Cheng, and their infrataxa - which share with them the salient character of the production of an anamorphic stage belonging to the genus *Antromycopsis*. Indeed they are not always easy to distinguish from these taxa. It was therefore decided to carry out pure culture studies as well as compatibility tests with other closely similar species. The methodology and results of these are discussed in detail in an appendix to this paper. A consideration of the results of these compatibility studies, together with an evaluation of traditional taxonomic criteria have led us to describe the South African collections as a new species. All material of this new taxon, including the holotype, dried material of basidiomes obtained in culture, and cultures used in the compatibility studies are preserved in PRU(M).

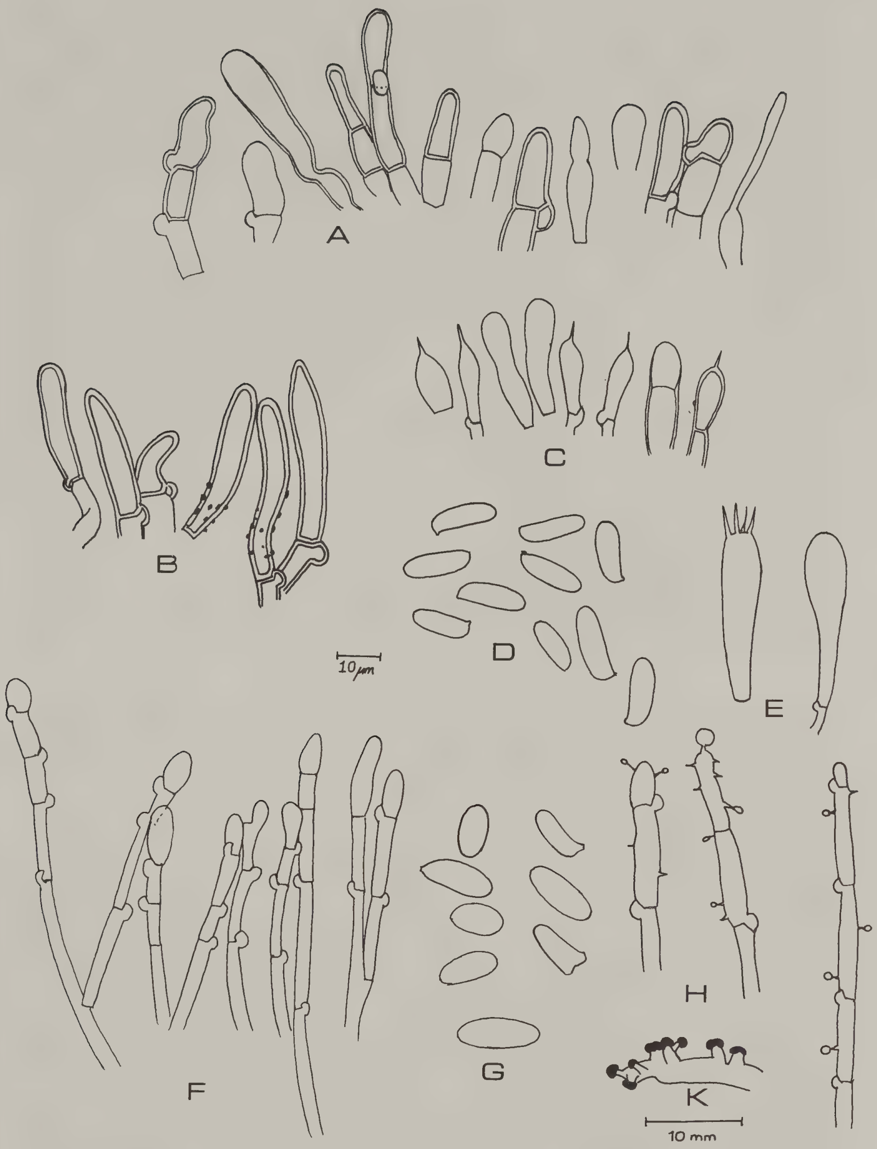
DESCRIPTION

Pleurotus fuscosquamulosus D.A. Reid & Eicker sp. nov. Figs. 1 - 4.

Status teleomorphosus

Sporophora robusta, lignatilia, vel truncis vel radicibus emergentia. Pilei ubi truncicoli pleurotoidei, 70 - 140 mm diametro, 7 - 110 mm radio, dimidiati vel flabellati, basin versus in stipem brevem lateralem attenuati, sed nonnunquam nonstipitatus. Margo pilei incurvatus vel deorsum curvatus, pileo concolor vel leviter griseus, integer vel in lobus profunde fissus. Superficies pallide cremeo bubalinus, squamis indistinctis, numerosis, minutis granularibus et pallide ochraceo-brunneis, vel squamis distincte sphacelatus. Pileus ubi contusus flavescens. Lamellae tenaces, elasticae, usque ad 10mm profunde, horizontales vel subdecurrens, cremeo-albae vel sordide albae, nonnunquam margine lamellarum plus flavido colorato; in exiccatis nonnunquam bubalinus, zona marginali fusco-grisea instructa. Stipes curtus, crassus, nonnunquam nullus, 15 - 30 x 10 - 25mm, ochraceus, sed infra lamellas griseus, coacto-hirsutus; raro denigratus vel reticulo denigrato ornatus. Caro alba, basi pilei usque 18mm crassa. Odor nihil distinctus.

Pileipellis cute hypharum repentum formata, sed nonnunquam indistincta. Cutis usque 100μm crassa, in sectione radiali leviter luteola, hyphis 3.5 - 5.5μm latis, horizontalibus parallelis, leviter agglutinatis, parietibus distinctis vel leviter incrassatis, septatis et fibulatis. Hyphae superficiales cutis segmentis terminalibus, tenuiter tunicatis, obtusis vel nonnunquam leviter clavatis usque 8μm diam. et saepe guttulis luteolis numerosis continentibus. Contextus pilei hyphis 4 -10μm latis, laxe intertextis, ramosis hyalinis septatis fibulatis parietibus distinctis vel leviter incrassatis, interdum hyphis gloeopleris 4.0 - 6.6μm latis, enteriformibus et refractivis. Squamae fuscae in pileo hyphis 6.6 (8.0)μm latis, repentibus, luteo-brunneis, parietibus tenuibus vel leviter incrassatis, nonnunquam pigmento brunneo fasciatus. E his hyphis pili curti erecti, aggregati, usque 60μm longi ortis. Hi pili unus vel tres segmentatus, plerumque luteo-brunneus, segmento terminali 16.5 - 35.0 (45.0) x 5.0 - 11.0μm, hyalino, cylindrico, clavato vel lanceato, fibulato, tenuiter tunicato. Trama lamellae irregularis, hyphis



Figs. 1A-K. A-E. *P. fuscosquamulosus* from holotype of teleomorph. A. Hairs from blackened surface of stipe. B. Hairs from black fleck-like scale on pileus. C. Cheilocystidia showing variation in form. D. Spores. E. Basidia. F-K from holotype of *Antromycopsis fuscosquamulosus*. F. Conidiophores. G. Conidia. H. Hyphae from near the base of the coremium showing fine sterigma-like outgrowths terminating in a minute conidium (?). K. Bar = 10 μm. Habit, showing coremia formed on white rhizomorph. Bar = 10 mm.

usque 10μm latis, intertextis, hyalinis, ramosis, fibulatis, parietibus distinctis vel leviter incrassatis. Subhymenium usque 13μm latum, hyphis 2 - 3μm latis, dense compactis, hyalinis, ramosis, fibulatis compositum. Cheilocystidia 10.0 - 32.0 x 3.5 - 9.0μm, plerumque praesentia, saepe abundantia, angustae subcylindrica, anguste clavata, clavata, ovata, vel fusoidea, parietibus tenuibus vel leviter incrassatis; ad apicem in cilium tenue sterigmatoides et apice capitulo minutissimo globosa vel ovoideo gerens. Margo lamellae cheilocystidiis aliis intermixtis, hae cheilocystidia, 16 - 32 x 5.5 - 9.0μm leviter plus grandes, cylindrica, clavata vel fusoidea, tunica tenui vel leviter incrassata. Pleurocystidia plerumque carentia, sed in sporophoris immaturis nonnunquam presentibus 50 - 94 x 6 - 9.0μm et e hymenio usque 20 μm protrudentia, subcylindrica vel subclavata raro elongato-lanceolata, ad apicem obtuse rotundata et tenuiter tunicata, basin versus angustata et in caudam elongatam prolongata, contentis carentibus, aliter tunica leviter incrassata, refractiva, et hyalina, basi fibulata. Basidia 36.0 - 57.0 x 5.0 - 7.5 (9) μm, quandrispora, tenuiter tunicata, hyalina, clavata, septo basali fibulato instructa. Pulvis sporarum albus. Sporae ex pulve 13.0 - 17.0 x 4.5 - 5.5 μm, hyalinae, cylindricae, nonamyloideae et nondextrinoideae, tenuiter tunicatae.

HOLOTYPE: On ground from roots of *Populus alba* (Salicaceae), Trimpark, Austin Roberts Reserve, Pretoria, Gauteng, D.A. Reid and Magda Nel , 16 Feb. 1993 [PRU(M) 3589 A]. Additional specimens seen:
On trunk of *Populus alba,* emerging from a knot hole about 2.5 m above ground level, Trimpark, Austin Roberts Reserve, Pretoria, Gauteng, D.A. Reid and Magda Nel , 16 Feb. 1993 [PRU(M) 3589 B]. This material was from the trunk of the same tree from the roots of which the holotype was also collected.

On trunk of a single tree of *Combretum molle* (Combretaceae), Goedehoop Farm, Vaalwater, Northern Province, Magda Nel, 18 Jan. 1995 [PRU(M) 3935 A -from roots; 3935 B from trunk].

Status Anamorphosus

Antromycopsis fuscosquamulosus D.A. Reid & Eicker sp. nov.

Coremia A. broussenetiae in mentem revocans. Coremia in cultura et in sporophoris formata. Coremia stipite laxe fibrilloso, albo et ad apicem guttula nigra aquosa instructa, ubi siccitascentia guttula indurescenti et fere applanato-discoidea, tum Myxomycetum minutissimum in mentem revocans. Coremia plerumque simplicia et discreta sed nonnunquam ex rhizomorphis albis crassis ortis, usque 1400 μm longa disco nigro usque 700 μm lato. Stipes coremii hyphis parallelis fasiculatis hyalinis septatis fibulatus, sed ad apicem divergentibus et conidiophoris formantibus. Conidiophora hyalina septata, segmento 8 - 40 μm longa, 3.0 - 3.5 μm lato; septa fibulis. Conidia 10.5 - 19.0 x (4.0) 5.5 - 6.5 μm plerumque cylindrica vel saepe suballantoidea vel breviter ellipsoidea, pallide brunnea, tunica distincta vel leviter incrassata, in catenis curtis formatus. Conidia nonnunquam basi reliquiis fibulae. In stipite coremii nonnullae hyphae externae segmentis hyalinis septatis nonnunquam spiculis sterigmatoideis. Haec spicula unum vel aliquot per segmentum apice in conidio minutissimo globosa terminantia. Spiculum ad apicem segmenti terminalis conidio plus grandi usque 4.4 μm diam.

HOLOTYPE: Dried culture [PRU(M) 3589 C] isolated from the holotype of the teleomorph (PRU(M) 3589 A), ie from roots of *Populus alba*, Trimpark, Austin Roberts Reserve, Pretoria, Gauteng, D.A. Reid and Magda Nel , 16 Feb. 1993

Pleurotus fuscosquamulosus D.A. Reid & Eicker **sp. nov.**

Basidiomes robust, growing from knot holes on standing trunks up to 2.5 m above ground level, or from the roots and then often appearing terrestrial. Pilei when truncicolous, pleurotoid, 70 - 140 mm diam., 7 - 110 mm radius, dimidiate to flabellate, narrowing behind - usually to a very short, but very broad stipe or stipe-like base, which may be virtually lacking; when terrestrial, basidiomes dimidiate or flabellate, but with a narrow rim at the base of the pileal surface, indicating an eccentric, or even initially centric development, and narrowed behind to a short, thick stipe-like base. Margin inrolled, or downcurved, concolorous or slightly greyish, entire or sometimes deeply split into lobes, but whether naturally or by accident is uncertain. Surface pale creamy-buff, ornamented with numerous indistinct pale ochre brown, to distinct dark brown granular fleck-like scales, which are often more evident toward the basal part of the pileus, but are sometimes uniformly distributed over the entire surface, or they may become fewer in a marginal zone to about 10 mm wide. When these small granular scales are dark brown in colour the pileus appears as if sprinkled with soot. In some basidiomes there may also be dark brown spot-like scales to 1 mm diam., toward the base of the pileus. On dying or when handled, the pileus is inclined to become more yellowish, and in exsiccatae the pileal surface becomes ochre-brown, and the soot-like scales are visible only under a lens. Lamellae tough, elastic, to 10 mm deep, horizontal to subdecurrent, running down the stipe as linear rudiments or forming a reticulum, creamy white to dirty white, sometimes with the edge more yellowish, and in exsiccatae sometimes buff with a darker marginal band. Stipe short, stout, sometimes broader than long, and in basidiomes emergent through knot-holes on tree trunks, seemingly absent, 15 - 30 x 10 - 25 mm; ochraceous, shading to grey at the base of the lamellar rudiments, felty hirsute, in one basidiome black, with blackish reticulum formed by anastomosis of the lamellar rudiments. Flesh white to creamy-white, to 18 mm thick at base of basidiome. Smell not distinctive. Pileipellis a cutis of repent hyphae but not always differentiated; when developed 70 - 100 µm thick, appearing slightly yellowish in section, of densely organized, parallel, horizontal, slightly agglutinated, clamp-bearing hyphae, 3.5 - 5.5 µm diam., with distinct or slightly thickened walls; superficial hyphae of the cutis with obtuse, sometimes slightly enlarged, thin walled endings to 8 µm diam., often containing numerous minute, yellow-brown guttules. Context of pileus of more loosely organized, interwoven, freely branched, hyaline, clamp-bearing hyphae, 4 - 10 µm diam., with distinct to slightly thickened walls. In some basidiomes with scanty enteriform, branched gloeoplerous hyphae, 4.0 - 6.6 µm diam., with refractive contents, but not staining differentially in ammoniacal Congo Red. Structure of fleck-like scales on pileus when pale and indistinct having much the same structure as the cutis, but when dark and sootlike having a clearly differentiated structure comprising yellow-brown hyphae to 6.0 (8.0) µm diam., with thin to slightly thickened walls, sometimes encrusted with transverse, zebrate bands of brown pigment (Fig. 2C). From these hyphae, tufts of short hairs arise, up to 60 µm long, each comprising two or three hyphal segment, usually yellow-brown in colour, with the terminal segments 16.5 - 35.0 (45.0) x 5.0 - 11.0 µm. The latter are likewise either hyaline or subhyaline, but more often yellow-brown in colour, and variable in shape from cylindric, clavate, or lanceolate, and thin to slightly thick walled with a clamp-bearing septum (Fig. 1B; 2C). Lamellar trama irregular, of tangled, interwoven, hyaline, freely branched hyphae, to 10 µm diam., with distinct to slightly thickened walls, and clamp-bearing septa; nearer to the subhymenium the hyphae are narrower and more densely organized to 6.6 μm wide. The trama is bounded on either side by a distinct subhymenium to 13 μm wide, of densely compacted, thin-walled, hyaline, clamp-bearing, branched hyphae, 2 - 3 μm diam. Surface of stipe when blackened having exactly the same structure as found in the dark fleck-like scales of the pileus, ie comprising short hairs, 17 - 46 x 6 - 7 (9) μm, which are either unicellular or formed of 2 - 3 segments, with distinct to slightly thickened brown walls and clamps at the septa; the terminal elements vary from cylindric or clavate to fusoid (Fig. 1A). Cheilocystidia usually present, and often abundant as small hyaline elements, 10.0 - 18.0 x 3.5 - 7.5 μm, varying from narrowly subcylindric or narrowly clavate, to clavate or ovate, with thin or occasionally very slightly thickened walls, and prolonged above into a very fine thread-like, or sterigma-like appendage up to 5 μm long [not included in the above measurements], terminating in a minute globose or ovoid capitulum, and with a basal clamp-bearing septum (Fig. 1C). Intermixed with these are other cystidial elements which may be slightly larger, thin-walled, or occasionally slightly thick walled, varying from cylindric to clavate, sometimes with a slight median constriction (Fig. 1C). In the immature specimen from Vaalwater, emergent from a knot hole, the gill edge beset with abundant elements, 16.0 - 32.0 x 5.5 - 9.0 μm, which are thin to slightly thick walled, varying from cylindric to subcylindric or fusoid, and occasionally with a single clamp-bearing septum additional to the clamped basal septum (Fig. 2B). It is probable that, some at least of these sterile elements represent the immature stages of the elements found on the gill edge of the basidiome at the base of the same tree, in which the apex is prolonged into a thread-like beak terminating in a tiny capitulum. Pleurocystidia usually lacking, but observed in the immature Vaalwater specimen mentioned above. These are 50 - 94 x 6 - 9 μm, subcylindric or subclavate, rarely elongate-lanceolate, with slightly thickened, refractive, hyaline wall, tapering gradually to a long narrow "tail" terminating at a basal clamp-bearing septum; apex obtusely rounded and usually thin-walled (Fig. 2A). The pleurocystidia which are devoid of contents, may or may not project beyond the basidia for up to 20 μm, and arise at a deeper level in the subhymenium than do the basidia. Basidia 36.0 - 57.0 x 5.0 - 7.5 (9.0) μm, thin walled, hyaline, clavate, 4 spored, with a basal clamp-bearing septum (Fig. 1E). Spore Print white in thick deposits. Spores from print 13.0 - 17.0 x 4.5 - 5.5 μm, from lamellae 11.5 - 17.0 x 3.5 - 4.5 μm, thin walled, hyaline, cylindric, non-amyloid and non-dextrinoid (Fig. 1D).

Habitat: From roots and of the same tree *Populus alba* (Salicaceae) (a) from roots (PRU(M) 3589 A) [HOLOTYPE]. (b) from knot hole on trunk about 2.5 m above ground level (PRU(M) 3589 B) Trimpark, Austin Roberts Reserve, Pretoria, Gauteng, D.A. Reid and Magda Nel, 16 Feb. 1993; From roots and trunk of the same tree of *Combretum molle* (Combretaceae) (a) from roots (PRU(M) 3935 A) (b) from knot hole on trunk about 2.5 m above ground level (PRU(M) 3935 B), Goedehoop Farm, Vaalwater, Northern Province, Magda Nel, 18 Jan. 1995.

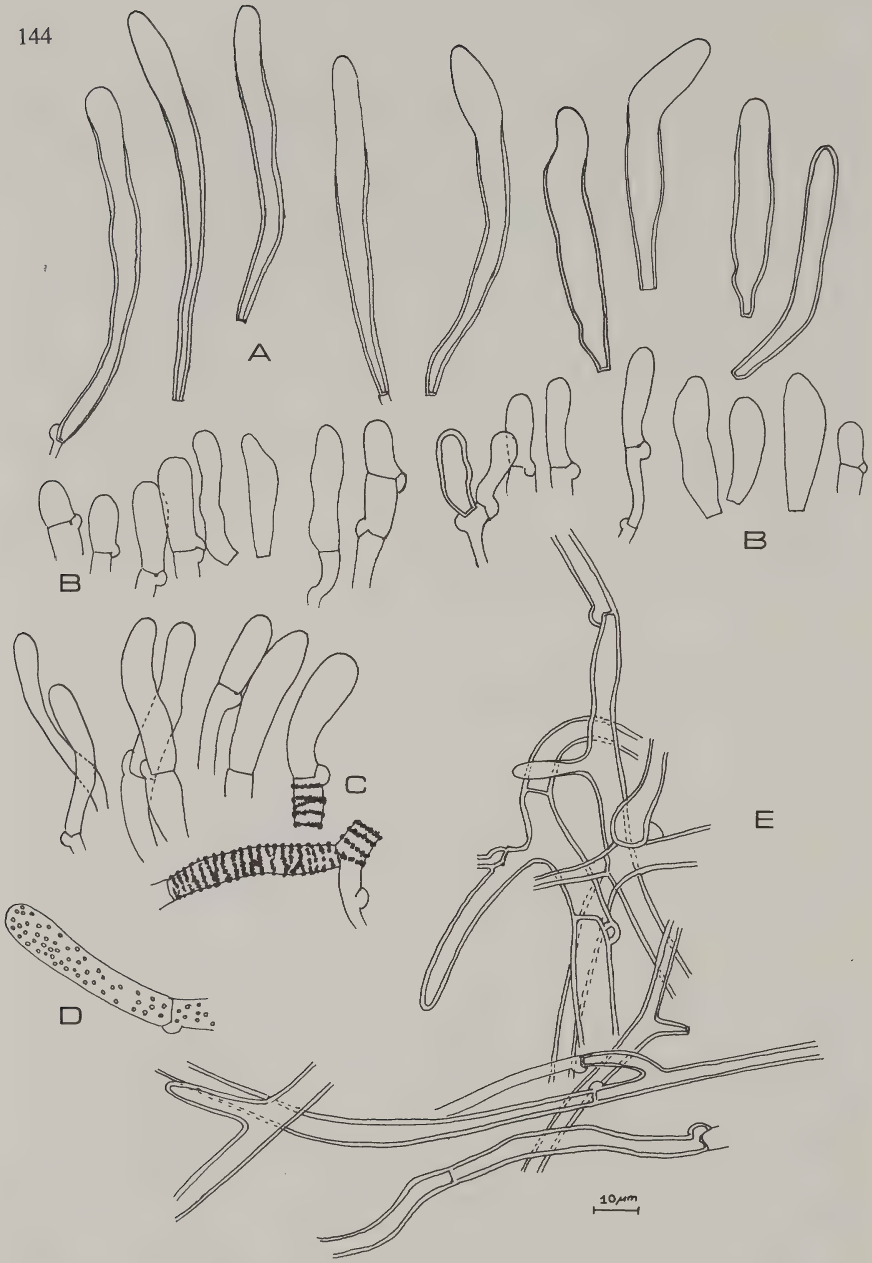
Anamorph

Antromycopsis fuscosquamulosus D.A. Reid & Eicker sp. nov.

An *Antromycopsis* coremial state was obtained in culture from isolates of both the truncicolous and terrestrial basidiomes of the Trimpark collection. Coremia also developed on the surface of basidiomes produced in culture. These coremia comprised a white stalk surmounted by a black watery droplet, drying to a flat or shallowly convex, black head, recalling the fructifications of a small Myxomycete, or minute agaric-like basidiomes. Most of the coremia were simple and discrete, but some developed on stout white mycelial cords (Fig. 1K); they were up to 1450 μm high, the stipe white and fluffy, the black head to 700 μm across when dry, but broader in the droplet phase. The coremia consist of fascicles of hyaline hyphae, which diverge and differentiate above to form ill defined, hyaline, septate conidiophores with clamp-connexions at the septa (Fig. 1F). The resulting segments of the conidiophore are 8 - 48 μm long, and 3.0 - 3.5 μm wide; conidia are borne apically. Conidia 10.5 - 19.0 x (4.0)5.0 - 6.5 μm, variable in shape, mostly cylindric, varying to suballantoid to short elliptic, pale brown, with a distinct to very slightly thickened wall; some conidia with the vestiges of a basal clamp-connexion in the form of a beak-like appendage (Fig. 1G). On the stipe of the coremia certain hyphae, especially near the base, have been observed, otherwise indistinguishable from those forming the stipe of the coremium, except that they bear extremely fine sterigma-like outgrowths to about 3 μm in length, one to several per segment, terminating in a tiny hyaline globular conidium (?). Some of these hyphae have the terminal element prolonged at the apex into a similar sterigma-like structure bearing a much larger globose conidium, to 4.5 μm diam. (Fig. 1H). One cannot help but draw a comparison between these sterigma-like outgrowths bearing globular entities, with the cheilocystidia of the teleomorph showing a similar apical structure.

Description of basidiomes obtained in culture: Basidiomes from the Trimpark material, originating from the roots (ie from the holotype) were obtained in culture from isolates inoculated on to straw bags and kept in a phytotron. Initially the isolates were grown on white sorghum grain (31 January 1995). The spawn was then mixed with wheat straw and grown at 22 °C, in alternating light (500 lux) and darkness, with a 90% relative humidity, except for a brief temperature shock administered on the night of May 14th, when the temperature was dropped to 15 °C. Pinning commenced on April 8th and basidiomes were harvested on June 19th. The cultured basidiomes were similar to those occurring in the wild in both macroscopic appearance and in their microscopic characters, as outlined above. However some amplification is necessary.

Basidiomes 72 - 85 mm diam., pleurotoid with a lateral stipe. Pilei flabellate , dimidiate to spathulate, either applanate or slightly depressed near the stipe; margin strongly enrolled at least in dried material. Surface creamy buff, bruising slightly yellow, but greyish in part due to a covering of fine, cobwebby, dark fibrils (best seen under a lens). However, due to disruption of the surface during growth, these fibrils are pulled apart and form small dark areolae at the centre of the pileus, and radially orientated V-shaped fibrillose scales extending outward to the periphery. Lamellae of varying length, fairly distant, creamy white to lemon yellow near the stipe. Stipe 20 x 13 mm, tapering downward, greyish cream. Pileipellis a cutis to 56 μm thick. Structure of the dark fibrillose scales on the pileus exactly as for the dark fleck-like scales on the pileus of the wild basidiomes. Lamellar trama subregular to irregular, flanked by a prominent subhymenial layer to 33 μm wide, in which the narrow branched hyphae appear somewhat agglutinated or gelatinised. Cheilocystidia present, of the cylindric to clavate type with an apical sterigma-like appendage terminating in a minute capitulum; these organs, 20 - 25 x 6 - 7 μm, are larger than those observed in the wild basidiomes. Basidia to 50(62) x 6 - 7 μm, hyaline, clavate, 4-spored, and with either thin or slightly thickened walls; both immature, and some mature basidia with sterigma, were



Figs. 2 A-E. *P. fuscosquamulosus* from teleomorph collected from knot-like hole, Vaalwater. A. Pleurocystidia. B. Cheilocystidia showing variation in form. C. Hairs from black fleck-like scales on pileus, and subtending hyphae with zebrate bands of brown pigment. D. Enlarged hyphal ending from cutis, containing yellow brown guttules. E. Hyphae from pileal context. Bar = 10 μm.

observed with thickened walls. Some of these immature 'basidia' were devoid of contents and might be interpreted as pleurocystidia. Spores 11.5 - 17.0 x 4.4 - 5.0 μm as in the wild basidiomes. NB.

On one of the cultured basidiomes a patch of coremia developed on the pileal surface. Coremia were produced abubdantly on the culture medium.

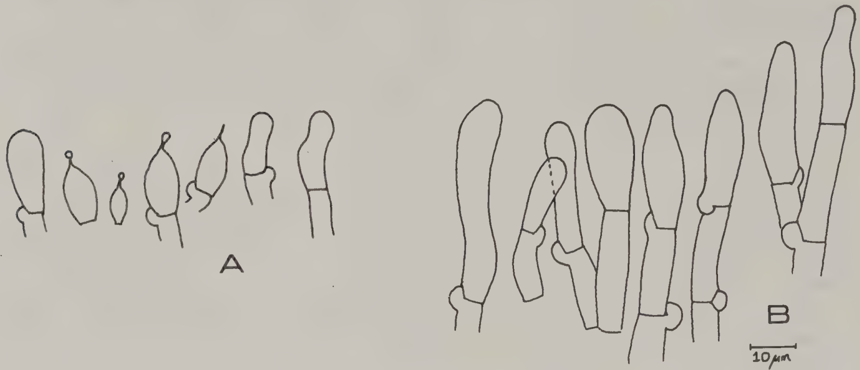
Distribution: Known only with certainty from South Africa: Trimpark, Austin Roberts Reserve, Pretoria, Gauteng; Vaalwater, Northern Province. In addition the *Antromycopsis* state was isolated by Dora Weintraub from cultures that arose on petri dishes opened in the Nourse Gold Mines, Gauteng. The latter has been shown to exhibit 100% intercompatibility with the trimpark collection

It should be noted that the collection of *Pleurotus* belonging to the subgenus *Coremiopleurotus*, and referred to *P. cystidiosus* O.K. Miller, has been reported from Bujumbura, Burundi by Buyck (1994). However, the author commented that his material differed from *P. cystidiosus*. "par les pleuro - et cheilocystides irrégulièrement rétrécies - sinueuses et trés étroites ressemblant aux cheilocystides de la forme typique". He went on to observed "Il s'agit peut-être d'une forme ou variété distincte. It would be interesting to know the results of pairing tests between the Burundi fungus and that from South Africa.

Observations on microcharacters: After a study of the surface structure of the pileus of *P. fuscosquamulosus*, we conclude that there are no true pileocystidia present. However, some authorities (Miller, 1969; Hilber, 1982; Guzman *et al.*, 1991), working with allied species eg. *P. cystidiosus, P. smithii, P. abalonus* etc, have interpreted the short tufts of yellow brown hairs comprising the fleck like scales on the pileus as pileocystidia. We reject this interpretation. For us these hairs are just slightly modified hyphae and may possibly represent incipient sites for future coremial development.
We are also slightly uneasy with regard to the interpretation of pleurocystidia in our South African material. These organs, which were only observed in a young sterile basidiome from Vaalwater, closely resembled immature and mature basidia, which also sometimes developed slightly thickened walls. Such thick-walled basidia can easily be confused with pleurocystidia at a casual glance. However, the latter organs, which lack contents, project from the hymenium, and appear to have a more deep seated origin in the subhymenium than do the basidia.

Relationships: *P. fuscosquamulosus* is very closely related to members of *Pleurotus* subgenus *Coremiopleurotus* and shares with them a similarity in macroscopic appearance, hyphal structure, 'pileocystidia' and spore characters as well as having a similar *Antromycopsis* anamorph. Difference with these taxa involve the hymenial cystidia. Nevertheless, utilization of these cystidial characters has limited practical value, since according to the literature they can be difficult to detect in microscope preparations and may vary from absent to abundant in different basidiomes of the same species, possibly as a result of the stage of maturity of the latter.

P. fuscosquamulosus is extremely similar to *P. cystidiosus* in macroscopic appearance, but according to the original description (Miller, 1969) the latter has cheilocystidia which are clavate, pyriform or ovate, narrowed below to a rather distinct pedicellate base, and measure 23 - 30 x 8.5 - 12 μm, but these were said to be "absent or frequent". Hilber (1982) reported similar cheilocystidia as did Guzman *et al.* (1991), although the latter authors reported the presence of two types of cheilocystidia. The more common type being that reported by Miller (l.c.), varying from globose or subventricose-globose with or without a mucron, and with a narrow subcylindric or cylindric base. The second type was noted as very scanty, varying from subcylindrical to subventricose, and frequently mucronate, measuring 13 - 26 x 6 - 9 μm.



Figs. 3. A-B. *P. fuscosquamulosus* from teleomorph collected from roots, Vaalwater. A. Cheilocystidia. B. Hairs from blackish spot-like scales on pileus. Bar = 10 μm.

Whether any of these cheilocystidia reported for *P. cystidiosus* correspond to those we have observed in *P. fuscosquamulosus* is uncertain. It is just possible that the second type reported by Guzman *et al.* (l.c.) may do so, although there is no indication that these organs develop an apical sterigma-like appendage terminating in a minute capitellum.

Miller (l.c.), in his original account of *P. cystidiosus* also reported the presence of pleurocystidia. These were described as 24 - 57 x 8.5 - 17 μm, varying in shape from clavate-rostrate or fusiform to ventricose, and were clearly well differentiated organs. However, Hilber (l.c.) reported that such organs were seemingly absent. In contrast Guzman *et al.* (l.c.) noted that they were abundant, and much of the same size and shape as originally described. In any event they appear to be more highly differentiated than any such organs in *P. fuscosquamulosus.*

Despite the similarity between *P. fuscosquamulosu* and *P cystidiosus,* cross pairing of monokaryotic isolates between the Trimpark material and an isolate of *P. cystidiosus* supplied by O K Miller showed no intercompatibility, yet pairings between the isolate of *P. cystidiosus*, from South African gold mines, with the same Miller isolate used in the Trimpark pairings, resulted in a 32.5% compatibility.

Recently Moncalvo (1995) described *P. cystidiosus* var. *formosensis* Moncalvo, which was said to differ from var *cystidiosus* in the lack of pileocystidia, in larger spores and by a strong yellow colouration to the edge of the lamellae. The cheilocystidia of the taxon, which were said to be rare, were described as "capitate, fusiform to ventricose, thin walled and hyaline in 5% aqueous KOH, and were noted as 35 - 42 x 6 - 7 μm. However, while a yellow colour is sometimes seen on the gill edge of *P.*

fuscosquamulosus, the description and accompanying text figure of the cheilocystidia of *P. cystidiosus* var. *formosensis* do not form a convincing match when compared with those of *P. fuscosquamulosus*. Clearly with *P. cystidiosus, P. abalonus* and *P. cystidiosus* var *formosensis* all recorded from Taiwan it would be of great interest to know something of the compatibility of these various taxa from this restricted geographical area.

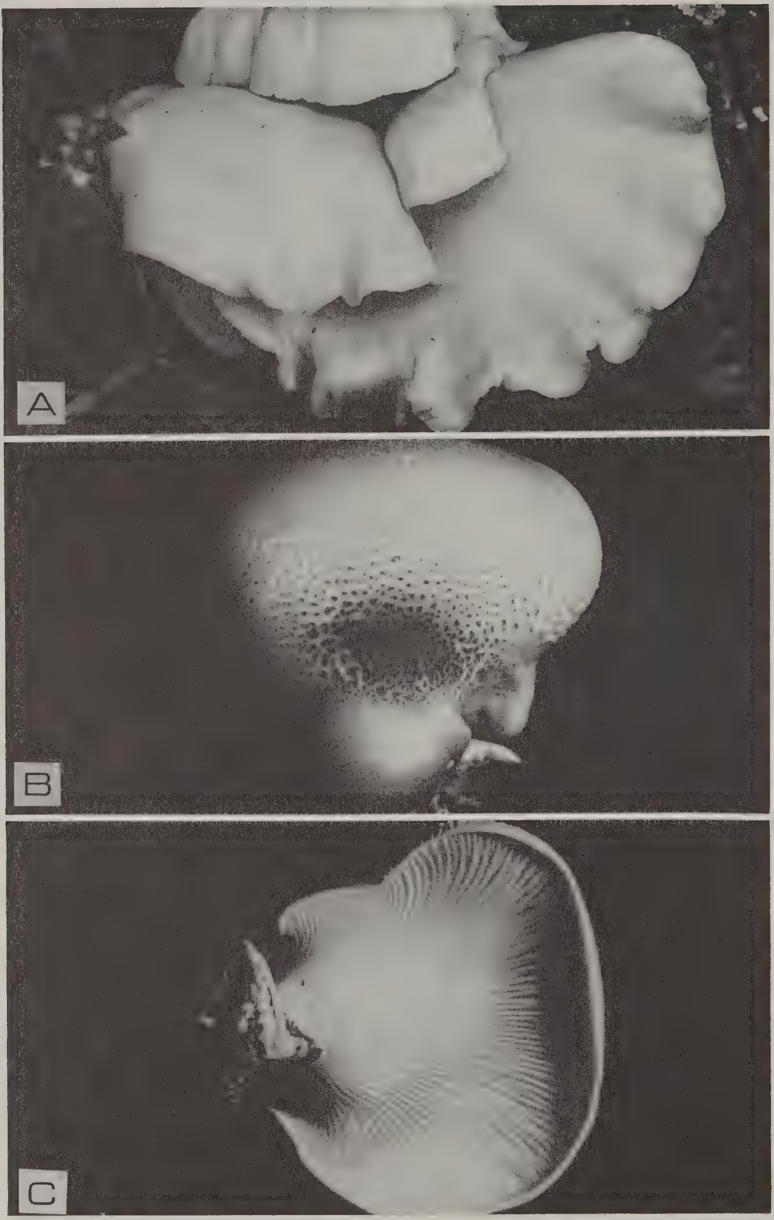
P. fuscosquamulosus is also similar to *P. smithii* Guzman, which was originally described from Mexico, and differs from it in the same way as it differs from *P. cystidiosus* ie in regard to hymenial cystidia. Both *P. cystidiosus* and *P. smithii* possess very similar pleurocystidia, and both have dimorphic cheilocystidia. However, the relative frequency of these organs are reversed in the two taxa. *P. smithii* has well differentiated pleurocystidia exactly like those of *P. cystidiosus*, but whereas they are abundant in the latter, they are only found in young basidiomes of *P. smithii*. Also, whereas the common type of cheilocystidium in *P. cystidiosus* is short, and globose to subglobose, in *P smithii* it is this type which is rare. In contrast it is the subcylindric type which is common in *P. smithii* and rare in *P. cystidiosus*. Again the cheilocystidia do not really match those which we have described for *P. fuscosquamulosus*.

Cross pairing of monocaryotic isolates between *P. fuscosquamulosus* and *P. smithii* show no compatibility. Similar pairing between isolates of *P. smithii* and *P. cystidiosus* show only 17.5% compatibility.

P. abalonus Han *et al.*, described from Taiwan, and known only from a single collection made in the wild (Moncalvo, 1995), is also closely related to our *P. fuscosquamulosus*. However, young basidiomes of the former appear to be darker in colour, varying between dark brown to black (Hilber, 1982). This is somewhat darker than we have observed for young basidiomes obtained in culture from isolates of our South African species. Nevertheless developing basidiomes of *P. abalonus* fade, and may eventually become ochraceous, while the surface disrupts into dark, radially fibrillose scales. In this stage of maturity the basidiomes of *P. abalonus* closely resemble those of *P. fuscosquamulosus*.

Hilber (l.c.) considered that *P. abalonus* showed diagnostic microscopic characters notably the production of distinctive cheilocystidia. These were described as irregulaly cylindric, initially hyaline, then yellow-brown with slightly thickened walls, measuring 21 - 39 x 5.3 - 6.4 μm. If these elements are of constant occurrence, and if they represent true cheilocystidia they would facilitate easy separation of *P. abalonus* from *P. fuscosquamulosus*. However, we consider that these brown, thick-walled structures are better regarded as incipient attempts at arthroconidium formation, comparable to similar elements comprising pileal scales of other members of subgenus *Coremiopleurotus*. This seems to us a plausible interpretation since coremial production can occur anywhere on the basidiomes of this group of related taxa. Whether these elements will prove to be constant feature of the gill edge in *P. abalonus* remains to be seen. No such elements were observed on the gill edge of *P. fuscosquamulosus*.

Hilber (l.c.) also regarded *P. abalonus* as having distinctive obtuse pileocystidia, ornamented with bands of a brown epimembranal pigment, and having a slightly thickened wall. These elements are said to measure 24 - 35 x 7.4 - 10.6 μm (base).



Figs. 4. A-C. *P. fuscosquamulosus*. Habit studies of the teleomorph. A. Basidiomes from roots. Vaalwater. B. Basidiome obtained in culture from the holotype showing pileal surface with dark scales. C. Same basidiome as B but showing lamellae.

Again we would not interpret these elements as pileocystidia. They appear remarably şimilar to hyphae we have observed in the dark pileal scales of our *P. fuscosquamulosus*. It is from these that tufts of short erect brown hairs arise, in which the individual elements resemble arthroconidia. Hence we would not regard these "pileocystidia" discussed by Hilber (l.c.) for *P. abalonus* as forming the basis of a distinction between it and our *P. fuscosquamulosus*.

An interesting additional feature of Hilber's (l.c.) account of the microstructure of *P. abalonus* is that he describes and illustrates caulocystidia on the upper stipe, which are extremely similar in size and shape to the cheilocystidia we described for *P. fuscosquamulosus* ie cylindric or clavate bodies with a fine apical sterigma-like appendage terminating in a minute capitellum (or perhaps a conidium). However, Hilber found these caulocystidia in *P. abalonus* to develop 1-3 sterigma-like appendages bearing a globose conidium, 5.3 - 5.8 μm diam. This suggests that similar structures might also occur on the lamellar edge of *P. abalonus*.

From the above discussion it is clear that while *P. fuscosquamulosus* is very closely related to the other members of *Pleurotus* subgenus *Coremiopleurotus*, it is genetically isolated from them. It would also seem that the *P. cystidiosus* complex comprises a number of newly differentiated and/or differentiating taxa, of which *P. fuscoquamulosus* is but one. Before the situation can be clarified we need the results of compatibility studies involving isolates from both widely different geographical areas, as well as the results of intensive studies of compatibility between the taxa occurring in a restricted geographical area such as Taiwan. Clearly more experimental work is needed to elucidate the taxonomic problems in this group of closely related taxa, which can be difficult to distinguish on the basis of traditional taxonomy.

ACKNOWLEDGEMENTS

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APPENDIX

Pleurotus crossings performed in this study

Somatic compatibility and interrelationships of the South African material with other members of *Pleurotus* subgenus *Coremiopleurotus, P. cystidiosus* O.K.Miller and *P. smithii* Guzman, were determined.

MATERIAL

The following dikaryotic cultures were used in this study:

A: *Pleurotus fuscosquamulosus*, isolated by D.A. Reid at Austin Roberts Trimpark (*UP 174)
B: *Pleurotus cystidiosus* kindly supplied by OK Miller (VT 1778) (UP 471)
C: *Pleurotus cystidiosus* obtained by A. Eicker from Taiwan Agricultural Research Institute (TARI), commercial strain (T 89) (UP 176)
D: *Pleurotus cystidiosus* American Type Culture Collection (ATCC 28598), collected from South African gold mines (UP 473)
E: *Pleurotus smithii* (ATCC 46391) (UP 475)

*UP number refers to the culture collection of the Mycology Unit, Department of Botany, University of Pretoria.

METHODS

It was assumed that isolates with clamp connections were dikaryotic and those without clamp connections monokaryotic. Monokaryotic isolates were established using the oxgall agar method and the dilution series method (Petersen, 1992; Zervakis *et al.*, 1994).
In the oxgall agar method different isolates were inoculated on 4% oxgall agar (Oxoid) and grown at 25 °C for up to 4 weeks. The colonies were regularly examined for the presence or absence of clamp connections. Portions of colonies without clamp clamps were transferred to malt extract agar (Petersen, 1992).

A dilution series was prepared of conidia collected from coremia growing on agar. Dilutions of 5 x 10^1, 5 x 10^2, 5 x 10^3 were streaked out on potato dextrose agar (PDA), malt extract agar (MEA) and yeast medium (CYM). As conidia started to germinate single spore isolates were made by selecting single spores under a microscope and transferring them to MEA or CYM plates. Colonies were examined regularly and those having no clamp connections (monokaryons) were used in the crossing experiments.

Crossings were done by inoculating isolates of two strains to be tested 10 mm apart on MEA plates and incubating the cultures for 2 weeks at 25 °C. Paired isolates were examined for the presence or absence of clamp connections in the contact zone. The mycelial morphology of the contact zone was carefully noted. A minimum of two sets of crossings, consisting of 10 replicates each were undertaken.

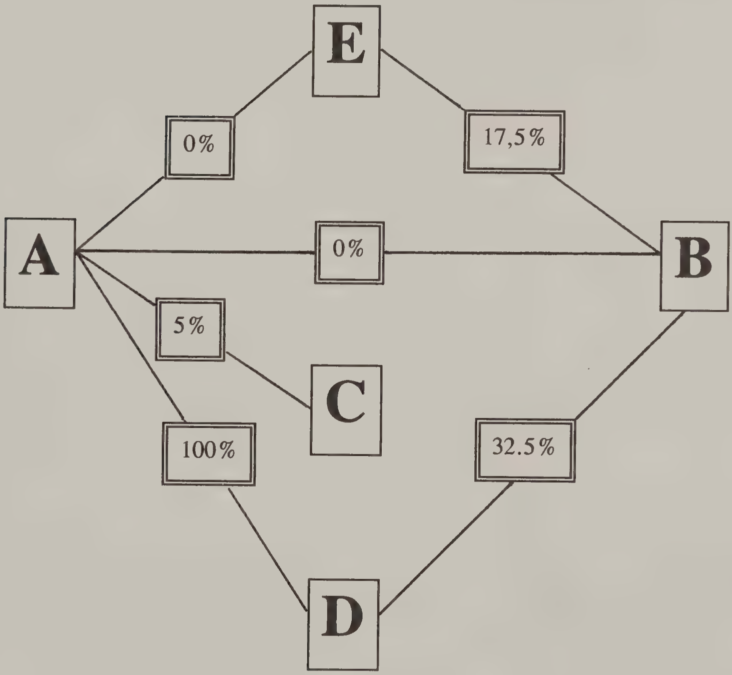
RESULTS

Monokaryotic isolates were established from *Pleurotus fuscosquamulosus* (A) and *P. cystidiosus* (B,C and D) dikaryons using the oxgall agar method. Growth on oxgall agar was extremely slow and dense. *P. smithii* (E) did not grow on oxgall agar at all.

Crossings: Crossing experiments to establish compatibility between monokaryons of *Pleurotus fuscosquamulosus* and the other isolates yielded the following results:

A - B	0% compatibility
A - C	0% compatibility
A - D	100% compatibility
A - E	0% compatibility
B - E	17.5% compatibility (7 of 40 plates had clamps)
B - D	32.5% compatibility (13 of 40 plates had clamps)

As a control crosses were made between the same isolates (i.e. A - A, B - B, C - C, D - D, E- E). In all these crosses clamps were observed in the contact zone.



Contact zone morphology: Observations on the contact zone morphology gave the following results:

A - B Mycelia of 2 isolates overgrew each other, no distinct

	contact zone
A - C	Brown colouring in agar adjacent to contact zone on the side of C
A - D	Contact zone forming a pronounced ridge
A - E	Mycelia of 2 isolates overgrew each other, no distinct contact zone
B - D	Mycelia of 2 isolates overgrew each other, no distinct contact zone

Crosses between the same isolates showed no distinct contact zone. The mycelia simply overgrew each other.

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SOUTH AFRICAN FUNGI 6. THE GENUS *LACTOCOLLYBIA* (BASIDIOMYCOTA) IN SOUTH AFRICA

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ABSTRACT

Following a generic account of *Lactocollybia* Sing. descriptions are given of the following new species from South Africa - *L. globosa* D.A. Reid & Eicker, *L. piliicystis* D.A. Reid & Eicker, and *L. variicystis* D.A. Reid & Eicker. A key is provided to facilitate identification of the South African members of the genus.

Key words: Basidiomycota, Tricholomataceae, *Lactocollybia*, *L. globosa*, *L. piliicystis*, *L. variicystis*, South Africa

INTRODUCTION

Hitherto knowledge of the occurrence of *Lactocollybia* Sing. in South Africa was based on the report of *L. epia* (Berk. & Br.)Pegler [as *L. angiospermarum* Sing.] by Reid (1975) from Port Natal. This followed the discovery that a specimen in K cited by Pegler (1986) in fact represented material of *L. epia*. However, apart from demonstrating the presence of the characteristic gloeosystem in the context, and spores having the size and shape of those of *L. epia*, the author was unable to provide additional microscopic data, and none relating to the fresh material. To date no further collections of *L. epia* have been made in South Africa, and a re-examination of the Sri Lankan specimen in K would be desirable to see if any additional microscopic data can be recovered from it, in order to check its identity.

The subsequent discovery of three new taxa of *Lactocollybia* in South Africa was, therefore, noteworthy. In particular it was very satisfactory to be able to observe *L. globosa* fruiting from the same mycelium during two successive seasons, so enabling the constancy of the micro-characters to be confirmed. Likewise for *L. piliicystis* where three different collections from the same locality, but produced by different mycelia, showed closely similar micro-characters.

Recognition of the new taxa, which can appear similar in the field, is based on differences in spore morphology and in cystidial characters. All three of these new taxa belong in Singer's (1986) Section *Albae* of the genus *Lactocollybia*.

DESCRIPTIONS

Lactocollybia Sing. in Schweiz Zeit. Pilzk. 17, 71.1939.

Sporophores lignicolous, or growing on plant debris, rarely terrestrial, solitary or gregarious, sometimes in dense swarms, collybioid, marasmioid or mycenoid, often with tough elastic texture. Pileus small, but reaching 5 cm. diam. in some species, usually expanding but in some species semiglobate with strongly inrolled margin, which scarcely separates from the stipe, smooth, hygrophanous or not, striate or not. Lamellae adnexed, adnate or decurrent, white to cream. Stipe central, smooth, sometimes pruinose (s.l.). Veil absent. Latex present in some extralimital species. Spore print white. Pileipellis a cutis of repent hyphae. Context of pileus of thin-walled hyaline hyphae up to 16(10) μm wide, with clamp connections at the septa in most species. Context of stipe similar to that of pileus but hyphae vertically orientated and parallel. Lamellar trama regular. Context of pileus and stipe, together with the lamellar trama, permeated by a well developed gloeosystem, comprising conspicuous elongated, fusoid segments, which taper markedly at either extremity, and which are often coloured yellow. These segments are discontinuous. Cheilocystidia present. Pleurocystidia: Gloeocystidia usually present as fusoid, elongate cylindric or subcylindric elements, often with yellow contents, but not or scarcely projecting beyond the hymenium. Spores neither amyloid nor dextrinoid, thin-walled hyaline mostly amygdaliform, broadly amygdaliform or pruniform, more rarely elongate ellipsoid or fusoid. Distribution tropical to subtropical.

Type species: *Lactocollybia lacrimosa* (Heim)Sing.

Lactocollybia epia (Berk. & Br.)Pegler, Agaric. Fl. Sri Lanka 77, 1986.
Agaricus epius Berk. & Br., *Journ. Linn. Soc. Bot.* 11, 517, 1871
Clitocybe epia (Berk & Br.)Sacc. Syll. Fung. 5, 190, 1887
Lactocollybia angiospermarum Sing. *Sydowia* 2, 32, 1948

The basis for the inclusion of this species rests on a report of its occurrence in South Africa, as *L. angiospermarum* by Reid (1975), who found that an herbarium specimen in K collected from Port Natal, coll. Wood, No 357A, determined as *Pleurotus aerotomentosus* (Kalchbr.)Sacc, was referable to this species. Reid (l.c.) gave a description of this dried material, but was only able to provide a limited account of the micro-characters, such as the presence of a gloeosystem of yellowish fusoid segments in the cuticle of the pileus, similar yellowish gloeocystidia on the face of the lamellae, and spores of the correct size and shape for *L. epia,* ie., 6.2 - 9.0 x 4.2 - 5.0 μm, thin-walled , hyaline and amygdaliform. So far as we are aware no other gatherings of this species have been made in South Africa to date.

It should be possible to distinguish *L. epia* from the other South African members of *Lactocollybia* by virtue of its larger, more elongate ellipsoid amygdaliform, or subfusiform spores, which according to Pegler (1977) measure 7.5 - 11.5 x 3.2 - 6.0 μm (Av. 8.5 x 5.0 μm), although he (Pegler, 1986) later somewhat changed his account of the spores to "ellipso-piriform to sub-amygdaliform, rarely subfusoid" based from collections from Sri Lanka. Even so the spores still appear more elongate than those of the other South African species which is described below as new.

Lactocollybia globosa D.A. Reid & Eicker, sp. nov. Fig. 1. A-E; Fig. 2. A-C

Sporophora caespitosa vel dense gregaria in trunco putrefacto insidentia. Pileus 10 - 15(20) mm diam., 7 -10 mm altus, hemisphaericus vel globosus, saepe profunde umbilicatus vel truncatus, elasticus, semper ad marginem valde et permanenter involutus; albus vel eburneus, ceraceus, nec hygrophanus nec striatus. Lamellae adnatae, usque 5 mm profundae. Stipes 35 - 50 mm longus, ad apicem 2 - 4(5) mm latus, basim versus angustatus, laevis, fistulosus, pileo concolorans, elasticus, saepe compressus et longitudinaliter sulcatus. Caro tenuis, alba. Odor non distinctivus. Hyphae contexti pilei, stipitis, et lamellarum hyalinae, fibulatae, tenuiter tunicatae, 4 - 10(16.5) μm diam. Contextus pilei et contextus stipitis gloeosystemate segmentarum hypharum luteorum conspicue fusiformium, usque 66 - 200(400) μm longorum et usque 10 μm latorum instructus. Trama lamellae regularis, hyphis 4.4 - 16.5 μm latis; subhymenium hyphis angustis, 2.5 - 3.3 μm latis, fibulatis, et tenuiter tunicatis formatum. Cheilocystidia 33.0 - 55.0 x 7.75 - 12.0 μm, fusoidea, ventricosa, breviter pedicellata, ad apicem obtusae vel plerumque capitata vel subcapitata, tenuiter tunicata vel tunica leviter crassescenti. Caulocystidia cheilocystidiis similaria. Gloeocystidia in margine et superficie lamellarum et superficie stipitis usque 70 μm longa, 6.5 - 8.8 (11.0) μm lata, elongato-cylindrica, ad apicem obtusa vel leviter fusoidea, sed basi in caudam elongatam prolongata. Basidia 22.0 - 31.0 x 5- 6.5 μm, hyalina, clavata, quadri-spora et tenuiter tunicata. Sporae 5.0 - 8.2 x 3.2 - 4.5 (5.0) μm, hyalinae, ubi maturae lacrimiformes vel leviter amygdaliformes, tenuiter tunicatae non-amyloideae et non dextrinoideae.

Sporophora caespitosa vel dense gregaria in trunco putrefacto Fici cordati subsp. salicifolia insidentia, University of Pretoria campus, 25.3.1997 [Holotypus in PRU(M) No. 4278].

Lactocollybia globosa D.A. Reid & Eicker, sp. nov.

Pileus 10 - 15 (20) mm., 7 - 10 mm high, hemispherical to globose, often with a pronounced and deep umbilicus, or with a truncate disc, always with an exceptionally inrolled margin, separating only slightly from the stipe, and having a tough elastic texture. Colour white, with a turgid waxy appearance, neither hygrophanous nor striate even when moist; on drying the entire fungus becomes distinctly cream coloured and in exsiccatae the colour may become yellowish. Lamellae adnate, to 5 mm deep, rather spaced, creamy white, darkening to a pale buff in exsiccatae. Stipe 35 - 50 mm high, 2 - 4 (5) mm wide at apex, often narrowing to the base, smooth, hollow, concolorous with the pileus both when fresh and dried, sometimes becoming yellow-brown in exsiccatae. The stipe which is hollow has a tough, elastic consistency, and is often laterally compressed, as well as being longitudinally grooved. Flesh thin, white. Smell not distinctive. Surface of pileus formed of hyphae, 5- 13 μm diam., thin-walled, hyaline, with clamp-connexions at the septa and IKI negative. Also present are long, fusoid, gloeohyphal elements 66 - 200 (400) μm long and up to 10 μm wide, tapering markedly at either extremity, and with uniform, refractive, vitreous contents. Pileal context of thin-walled, hyaline, clamp-bearing hyphae, 4 - 9 μm diam. [Av. 6 - 7 μm] together with similar yellowish fusoid gloeohyphae, either scattered throughout or concentrated just below the surface of the pileus. Stipe context similar in structure to that of the pileus and with similar fusoid gloeohyphae. Surface of the stipe in 1996 material having at the apex thin-walled, hyaline, clavate elements, 21 - 45 x 8 - 13 μm, provided with a clamped base, caulocystidia and caulogloeocystidia also present (see below). Lamellar trama regular, of thin-walled, hyaline, clamped hyphae, 4.4 - 16.5 μm diam., flanked by a subhymenium comprising narrow, thin-walled, hyaline hyphae 2.5 - 3.3 μm wide, with clamp-connections. Cheilocystidia 33.0 - 55.0 x 7.75 - 12.0 μm, fusoid with a ventricose base, tapering below to a short pedicillate portion, and prolonged above into a narrow elongated neck, terminating in an obtuse apex, or slightly enlarged to a capitate or subcapitate apex, 3 - 4 μm diam. These organs are thin-walled or they may develop very slightly thickened walls. Caulocystidia 31 - 60 x 6 - 8 μm similar to the cheilocystidia, but perhaps slightly narrower. Gloeocystidia present on the edge and face of the lamellae, and also on the surface of the stipe. When present in the hymenium they may project for up to 26 μm beyond the basidia. These organs originate as thin-walled, hyaline elements, with uniform yellowish vitreous contents, varying in shape from lanceolate or pyriform to subcylindric, and measuring 20 - 25 x 6 - 8 (11) μm. They soon lengthen to elongate cylindric with an obtuse apex or to fusoid, and taper below to an elongated narrow "tail"; they measure up to 70 μm in length and are 6.5 - 8.8 (11.0) μm wide. On the stipe, in common with the superficial hyphae, they have been observed to show inconspicuous but dense zebrate bands of encrusting pigments. Basidia 22.0 - 31.0 x 5- 6.5 μm, thin-walled, hyaline clavate, 4-spored. Spores 5.0 - 8.2 x 3.2 - 4.5 (5.0) μm, thin-walled, hyaline, varying from ovoid to almost subglobose when immature, to tear-shaped or pip-shaped at maturity.

Habitat: gregarious to caespitose in a dense swarm, over decaying stump of *Ficus cordata* subsp. *salicifolia* Wahlberg, at entrance to basement of Mathematics Building, University of Pretoria campus, coll. D.A. Reid, 25 March 1997 [Holotype PRU(M) 4278]. Also from the same stump, 12 February 1996 [PRU(M) 4067].

Lactocollybia globosa is similar to *L. epia* [Syn. *L. angiospermarum* Sing.], which has been fully described by Pegler (1977), who reported it for the first time from East Africa; while Reid (1975) recorded it previously from South Africa. Judged from Pegler's account, the latter species differs from *L. globosa* in having much longer basidiomes, in which the pileus expands normally, to become campanulate or plano-convex with a broad obtuse umbo. In addition the pileus of *L. epia* is hygrophanous and translucent-striate when moist, and the margin is straight. There also seems to be a spore difference between the two taxa; those are *L. epia* appear larger [7.5 - 11.5 x 3.2 -6.0 μm in *L. epia*, versus 5.0 - 8.2 x 3.2 - 4.5 (5.0) μm in *L. globosa*] and more conspicuously elongated to fusiform than those of *L. globosa*. A marked difference also exists between both the cheilo- and caulocystidia of the two taxa; those of *L. globosa* are fusiform with a narrow neck terminating in a well defined capitate, or subcapitate apex, whereas those of *L. epia* are cylindric-clavate with a slight subapical constriction (see Pegler, l.c. Fig. 3.3d). Furthermore, the hyphae of the basidiomes of *L. globosa* seem to show a greater tendency to inflation compared with those of *L. epia*. Finally, whereas *L. globosa* grows in large troops on rotting wood there is no evidence that *L. epia* does so.

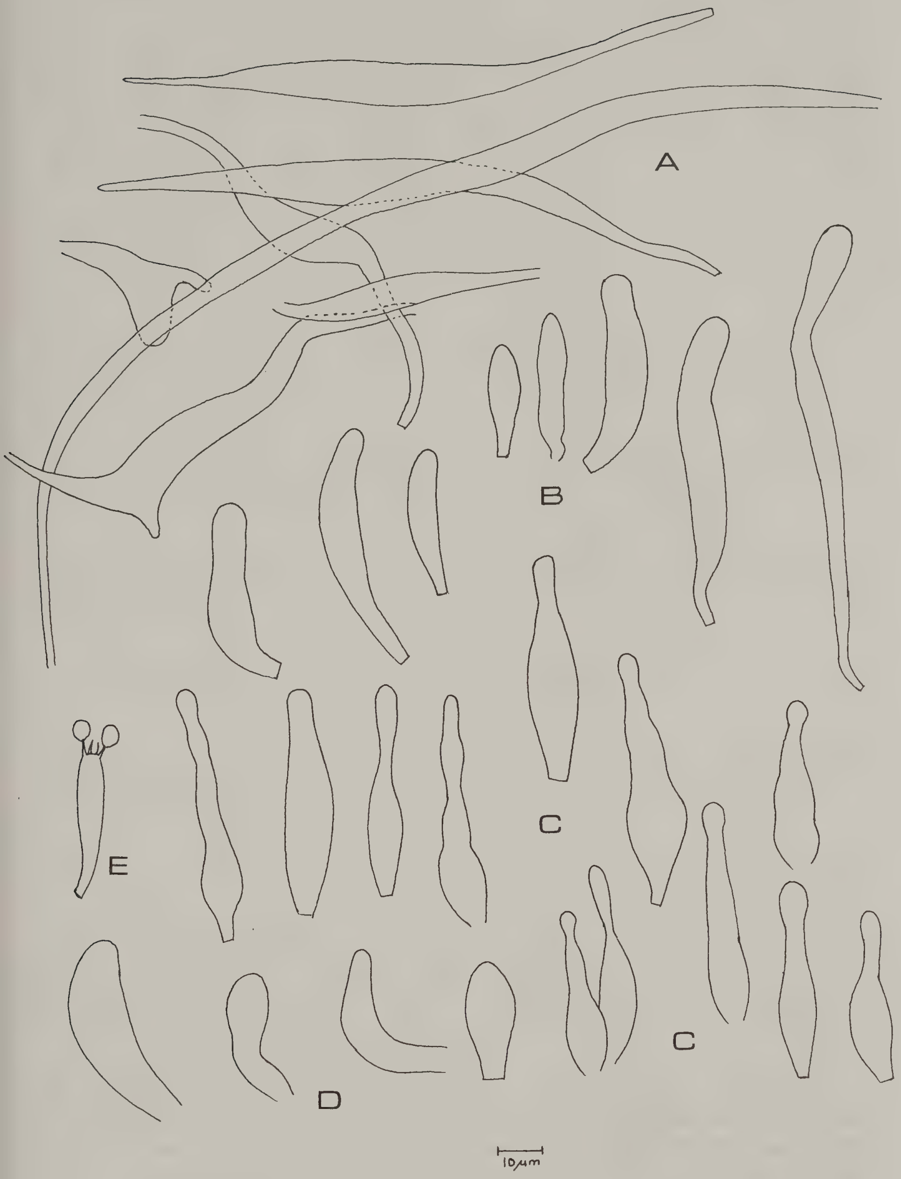

Fig. 1. A-E *Lactocollybia globosa*. A. Elongated fusoid segments of the gloeosystem in the context of the pileus from just beneath the pileipellis. B. Gloeocystidia from the face of the lamellae. C. Cheilocystidia. D. Gloeocystidia from the surface of the stipe. All from holotype. Bar = 10 μm.

Lactocollybia piliicystis D.A. Reid & Eicker, sp. nov. Fig. 3. B-G

Sporophora lignicola. Pileus 5 - 15 mm, convexo-campanulatus vel convexus, laevis vel aliquantum furfuraceo-pruinosus, leviter hygrophanus, omnino albus dein cremeus vel luteo-cremeus, margine aquosa. Lamellae late adnatae vel decurrentes, albae vel cremeae. Sporophora in sicco omnino luteola. Stipes 5 - 20 mm altus, 1 - 2 mm latus, albus, laevis vel tomentoso-pruinosus (s.l.), ad substratum disco albo myceliali affixus. Textura tenax, elastica. Contextus pilei hyphis, usque 19 μm latis, hyalinis, fibulatis et tenuitunicatis formatus, et segmentis gloeosystematis, usque 92 - 150 μm longis, et 5 - 11 μm latis, luteis, vitreis, refractivissimis, fusiformibus. Segmenta lutea fusiformia similia in contexto stipitis et in trama lamellarum. Trama lamellarum regularis, hyphis usque 13.2 μm latis, hyalinis, fibulatis tenuiter tunicatis formata. Subhymenium angustum, non valde definitum. Contextus stipitis hyphis, usque 13.2 μm latis, hyalinis, parallelis, fibulatis et tenuiter tunicatis formatus, segmentis gloeosystematis fusiformibus, luteis. Cheilocystidia usque 20 - 40 μm longa, hyalina, tenuiter tunicata, lageniformia vel fusiformia, nonnunquam basi inflata, 3 - 7 μm lata, apicem versus collo angusto, 1.5 - 3.0 μm lato, saepe in capitulum terminanti. Pleurocystidia: gloeocystidia e gloeosystemate formata. Haec gloeocystidia 20 - 32 μm longa, 5.0 - 7.5 μm lata, lutea, brevia, lanceolata vel elongato-cylindrica vel subcylindrica, et ad apicem obtuse rotundata vel nonnunquam leviter mucronata, tenuiter tunicata. Caulocystidia cheilocystidiis similia sed minoria etiam; gloeocystidia usque 80(132) μm longa, 8- 10 μm lata, lutea, breviter lanceolata, elongato-fusiformia, vel raro elongato-clavata, ad apicem mucronata, in superficie stipitis praesentia. Pileocystidia: superficies pilei gloeocystidiis, usque 23 - 70 x 5 - 8 μm, ut in superficie faciali lamellae. Basidia 11 - 18 x 4 - 5 μm, hyalina, clavata, tenuiter tunicata, quadrispora. Sporae (4.75)5.75 - 6.2(6.75) x 3.2 - 4.2 μm, raro usque 9.0 x 4.5 μm, amygdaliformes, pruniformes vel ovatae, hyalinae, non-amyloideae et non-dextrinoideae, tenuiter tunicatae.

On wood, New Agatha Forest, Mpumalanga, D.A. Reid & A. Eicker, 20 March 1992 [PRU(M) 3343 (Holotype)]. Other specimens seen from the same locality and with the same collection data - PRU(M) 3342.

Lactocollybia piliicystis D.A. Reid & Eicker, sp. nov.

Pileus 5 - 15 mm, convexo-campanulate to convex, smooth to somewhat scurfy-pruinose, slightly hygrophanous, entirely white becoming cream to yellowish-cream, with a more water-soaked striate margin, but on drying becoming opaque. Lamellae broadly adnate to decurrent, white to cream. Entire basidiome becoming yellowish when dried. Stipe 5 - 120 mm high, 1 - 2 mm wide, wide, smooth or hairy-pruinose (s.l.), attached to the substratum by a whitish mycelial disc. Texture tough elastic. Context of pileus formed of hyaline, thin-walled, clamp-bearing hyphae to 19 μm diam., with clamp-connexions at the septa. The context is permeated by yellowish, vitreous, highly refractive, fusiform segments of an extensive gloeosystem found throughout the basidiome, ie., in the context of both pileus and stipe, and to a lesser extent in the lamellar trama. These fusiform segments, 82 - 150 μm long and 5 - 11 μm wide, are particularly abundant just beneath the pileipellis. Trama of lamellae regular, of thin-walled, hyaline, clamp-bearing hyphae, to 13.2 μm diam. Subhymenium narrow and poorly defined. Context of stipe formed of thin-walled, parallel hyphae, to 13.2 μm wide, with clamp-connections at the septa; the context of the stipe is also permeated by

the gloeosystem comprising yellow gloeohyphae, and discontinuous yellow or hyaline, refractive, fusoid segments. Cheilocystidia abundant, thin-walled, varying from lageniform to fusiform, 20 - 40 μm long, comprising a slightly swollen base, 3 - 7 μm wide, tapering above into a narrow neck, 1.5 3.0 μm wide, terminating in a obtuse apex, and below into a short stalk. Pleurocystidia: closely resembling the cheilocystidia, may be present in this species. The gloeosystem gives rise to yellowish gloeocystidia on the gill face; these elements 20 - 32 μm long, 5.0 - 7.5 μm wide, vary in shape from short lanceolate to elongate-cylindric or subcylindric, with an obtusely rounded, mucronate apex, and have thin or distinct walls. Caulocystidia: the gloeosystem gives rise to gloeocystidia on the surface of the stipe, especially toward the apex, these are similar to those found on the gill face, and are up to 80(132) μm long, and 8 - 10 μm wide. Also present, especially near the stem apex are caulocystidia, which are similar to the cheilocystidia but smaller. Pileocystidia: gloeocystidia similar to those on the pileal surface. These elements are thin-walled, hyaline or yellowish, and may be short or elongate; they taper apically to a pointed tip and basally to a long tail, and vary from narrowly fusoid or lanceolate to cylindric, 23 - 70 x 5 - 8 μm. Basidia 11.0 - 18.0 x 4.0 - 5.0 μm, thin-walled, hyaline, clavate, 4-spored. Spores (4.75)5.75 - 6.2(6.75) x 3.2 - 4.5 μm (from mount taken from gill), an occasional spore measuring up to 9.0 x 4.5 μm (including the apiculus), thin-walled, hyaline, non-amyloid, non-dextroid, varying from amygdaliform or pruniform to ovate.

Habitat: on wood, New Agatha Forest, Mpumalanga, D.A. Reid & A. Eicker, 20 March 1992 [PRU(M) 3343 (Holotype)]; Also another gathering with the same collection data [PRU(M) 3342].

L. piliicystis is characterized by having hair-like cheilocystidia and small amygdaliform spores.

Lactocollybia variicystis D.A. Reid & Eicker, sp. nov. Fig. 2. D-H; Fig. 3. A

Sporophora gregaria dispersa in trunco Salicis. Pileus 2 - 18 mm diam., primo convexus dein applanatus, laevis margine leviter striatus vel plicatus. Lamellae adnexae, saepe dente instructae, cremeo-albae, nonnunquam furcatae. Stipes usque 32 mm altus, 1 - 1.8 mm latus, basi usque 3 mm latus, cylindricus, cremeo-albus, laevis sed sub lente pruinosus, et ad substratum disco albo myceliali affixus. Contextus pilei, lamellae et stipitis segmentis gloeosystematis fusiformibus, refractivissimis, vitreis, luteis, usque 150 μm longis, 11.6 μm latis. Hyphae contexti pilei 4 - 11.6 μm latae, hyalinae, fibulatae, intertextae, tenuiter tunicatae. Trama lamellarum regularis, hyphis usque 16.5 μm latis, hyalinis parallis, fibulatis, tenuitunicatis formata; et segmentis gloeosystematis fusoideis luteis et refractivis similiter praesentibus. Cheilocystidia 17 - 40 x 5 - 11 μm, forma variabili, lageniformia cylindrica, fusiformia vel lanceolata, vel basi inflata et prolongata in collum elongatum, saepe ad apicem in capitulum terminans. Pleurocystidia ut pote gloeocystidia, usque 40 x 9 μm, obtuse cylindrica vel subcylindrica, refractiva, vitrea et lutea, e gloeosystemate formata. Caulocystidia cheilocystidiis similia sed minora. Basidia matura non visa. Pulvis sporarum in sicco cremeus. Sporae e pulve re sporarum 6 - 8 x 4- 6 μm, late amygdaliformes, hyalinae, tenuitunicatae, guttula conspicua, non-amyloideae et non-dextrinoideae.

Lactocollybia variicystis D.A. Reid & Eicker, sp. nov.

Pileus 2 - 18 mm diam., at first convex then expanding, becoming flattened, smooth, slightly striate or plicate at the margin. Lamellae adnexed, often with decurrent tooth, creamy white, sometimes forked at the margin of the pileus. Stipe to 32 mm high, 1 - 1.8 mm wide, to 3mm wide at the base, cylindric, but sometimes flattened and longitudinally grooved, creamy white, smooth, but pruinose under a lens, attached to the substrate by a white mycelial disc. Context of pileus, lamellae and stipe permeated by a conspicuous gloeosystem of disconnected fusoid elements to about 150 μm long and to 11.6 μm wide, tapering markedly but gradually at either end, highly refractive with a uniform vitreous appearance. Hyphae of the pileal context, 4.0 - 11.6 μm wide, thin-walled, hyaline, interwoven, with clamp-connexions. Lamellar trama regular, of thin-walled, hyaline, parallel hyphae, to 16.5 μm wide, with clamp-connexions; occasional yellowish, fusoid segments of the gloeosystem present. Hyphae of the stipe thin-walled, hyaline, parallel, 3.3 - 8.0 μm diam., together with fusoid yellowish refractive segments of the gloeosystem. Cheilocystidia 17 - 40 x 5 - 11 μm, very variable in shape from lageniform, cylindric or fusiform to lanceolate, or with a swollen base abruptly contracted into a long undulating neck, terminating in an obtusely rounded or capitate apex, 4.0 - 8.5 μm diam. Pleurocystidia: the gloeosystem gives rise to blunt cylindric or subcylindric gloeocystidia, with a highly refractive, yellowish, vitreous appearance. These organs which curve into the hymenium, without protruding from it, are up to 40 x 9.0 μm. Caulocystidia similar to the cheilocystidia but smaller. Basidia: mature basidia not seen. Spore print cream in dried material. Spores from spore print 6.6 - 8.0 x 4.0 - 6,0 μm, thin-walled, hyaline, broadly amygdaliform, with a conspicuous oil droplet, non-amyloid and non dextrinoid.

Habitat: Gregarious and scattered, on stump (?*Salix* sp.), Trimpark, Austin Roberts Reserve, Pretoria, Gauteng, D.A. Reid & Magda Nel, 16 Feb. 1993. [Holotype, PRU(M) 3543].

This species is similar to *L. globosa* D.A. Reid & Eicker but differs from it, in that it grows scattered on the substrate and does not form large troops.

L. piliicystis D.A. Reid & Eicker and *L. variicystis* D.A. Reid & Eicker both produce basidiomes which expand normally at maturity, whereas in *L. globosa* the margin of the pileus remains strongly inrolled and scarcely separates from the stipe, even when fully mature. Further, while *L. globosa* has cheilocystidia which are rather constantly both elongate and fusoid, those of *L. variicystis* have a more variable shape, while those of *L. piliicystis* are less well differentiated and hair-like. There are also less differences in spore morphology; the spores of *L. variicystis* are proportionally both shorter and broader, and appear more distinctly amygdaliform or pip-shaped than those of *L. globosa*; those of *L. piliicystis* are likewise more distinctly amygdaliform, but smaller.

Lactocollybia variicystis differs from *L. epia* (Berk. & Br.)Pegler [*L. angiospermarum* Sing.] as described by Pegler (1986) in the smaller size of its basidiomes, differently shaped cheilocystidia [they are cylindrico-clavate in *L. epia*] and more broadly amygdaliform spores.

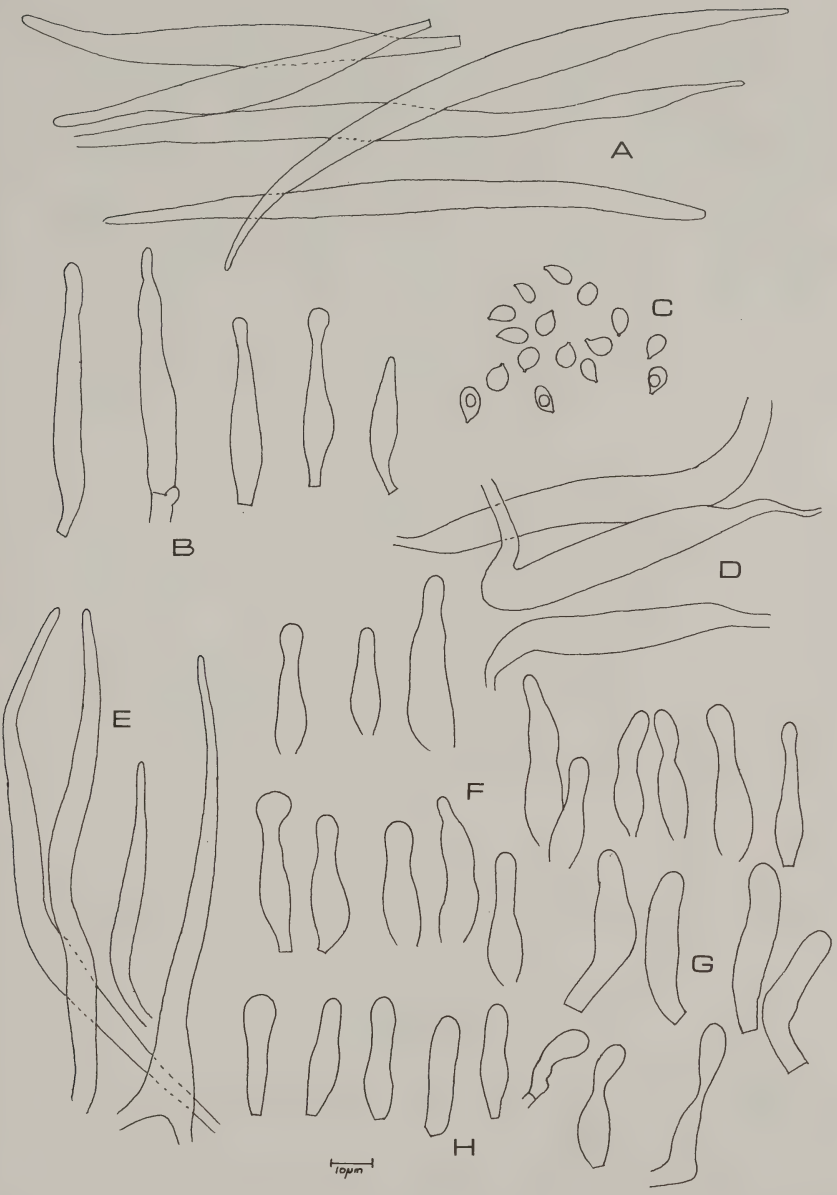

Fig.2. A-H. A-C. *Lactocollybia globosa*. A. Elongated fusoid segments of the gloeosystem from the context of the stipe. B. Caulocystidia. C. Spores. All from holotype.
D-H. *L. variicystis*. D. Elongated fusoid segments of the gloeosystem in the context of the pileus from just beneath the pileipellis. E. Similar elongated fusoid segments of the gloeosystem of the context of the stipe. F. Cheilocystidia. G. Four gloeocystidia from the face of the lamellae. H. Caulocystidia. All from the holotype. Bar = 10 μm.

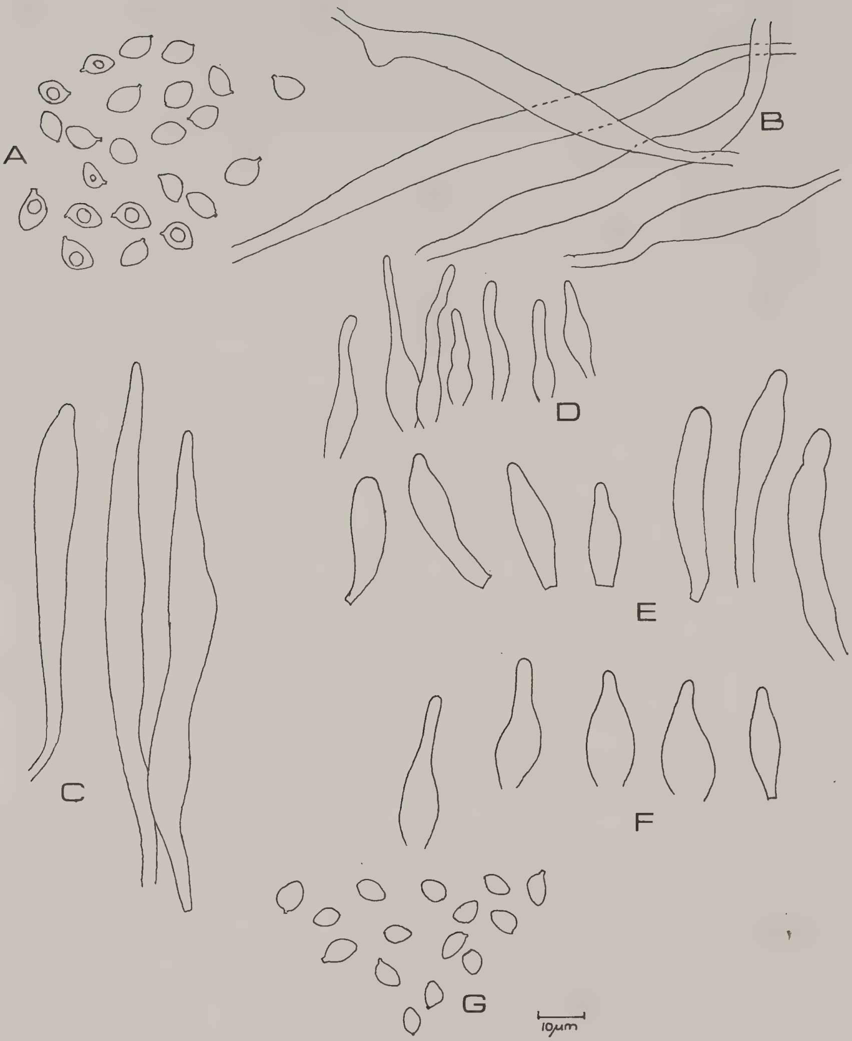

Fig. 3. A-G. A. *Lactocollybia variicystis*. A. Spores from the holotype. Fig. B-G. *L. piliicystis*. B. Elongated fusoid segments of the gloeosystem in the context of the pileus from just beneath the pileipellis. C. Elongated fusoid segments of the gloeosystem on the stipe. E. Gloeocystidia from the face of the lamellae. F. Caulocystidia. G. Spores. All from the holotype. Bar = 10 μm.

Key to the South African species of *Lactocollybia*

1 Basidiomes produced in dense swarms on and around rotting stumps; pilei globose to subglobose, margin scarcely separating from the stipe and permanently inrolled. Cheilocystidia and caulocystidia elongate-fusoid, with a ventricose base and long narrow neck, terminating in an obtuse or capitate apex. Spores 5.0 - 8.2 x 3.2 - 4.5(5.0) μm, varying from ovoid to almost subglobose when young, becoming tear-shaped or pip-shaped at maturity .... *L. globosa*

1 Basidiomes not produced in dense swarms, but growing scattered over rotting wood, stumps, etc., pilei expanding; margin not permanently inrolled. Cheilocystidia and caulocystidia differently shaped and more variable. Spores otherwise 2

2 Spores elongate-amygdaliform, elongate ellipsoid or fusoid, 7.4 - 11.5 x 3.2 - 6.0 μm [Av. 8.5 x 5.0 μm]; cheilocystidia cylindric-clavate with a subcapitate apex, 4 - 8 μm wide. Pilei to 5.5 cm diam. .... *L. epia*

2 Spores not conspicuously elongated. 3

3 Both cheilocystidia and caulocystidia variable in shape, lageniform, cylindric or fusiform in a long undulating neck, terminating in an obtusely rounded or capitate apex, 4.0 - 8.5 μm wide. Spores broadly amygdaliform, 6.6 - 8.0 x 4.0 - 6.0 μm. .... *L.. variicystis*

3 Cheilocystidia and caulocystidia less strongly differentiated, varying from lageniform to fusiform with a slightly swollen base, tapering above into a long narrow neck, terminating in an obtuse apex, 1.5 - 3.0 μm wide. Pleurocystidia possibly present. Spores varying from amygdaliform or pruniform to ovate; 4.75 - 6.2 (6.75) x 3.2 - 4.5 μm, smaller than in the preceding species. .... *L. piliicystis*

ACKNOWLEDGEMENTS

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THE GENUS CREPIDOTUS FROM THE STATE OF PARANÁ, BRAZIL[1]

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Abstract

43 annotated collections of *Crepidotus* from Paraná, Brazil are identified. They represent 16 species, mainly from stirps *Mollis* s.l. , stirps *Applanatus* s.l. and stirps *Brunswickianus*. SEM pictures reveal the exact type of spore ornamentation. A key is provided. *Crepidotus acanthosyrinus, C. albidus* var. *boliviae, C. antillarum, C. aquosus, C. catamarcae, C. cystidiosus, C. epibryus,* and *C. sublevisporus* are reported for the first time from Brazil. *Crepidotus croceitinctus* var. *cystidiophilus* and *C. euterpicola* are newly proposed.

Species of *Crepidotus* Fr. (Staude) (Agaricales, Basidiomycetes) have been sparsely recognized in many parts of South America, especially Brazil. Horak (1964) and Singer (1973) collected mainly in Argentina, Dennis (1974) in Venezuela. Singer lists 8 species from Brazil, Pereira (1990) 10 from the neighbouring state of Rio Grande do Sul. All species reported here have not been mentioned previously for the state of Paraná. For many it is the first report for Brazil. Previous studies (e.g. Senn-Irlet, 1995) showed the importance of spore ornamentation as revealed in the scanning electron microscope for the search of natural groups within the genus *Crepidotus*. This study confirms the importance of this character.

MATERIAL AND PRESENTATION

Characters present in all *Crepidotus* collections studied have not been mentioned. These characters include: lamellae dry, veil absent, colour of context and surfaces unchanging, spores lacking germ-pore and plage, never angular (also in polar view), chryso- and gloeocystidia absent and pileipellis without seta-like cells. Frequently not mentioned are the taste of the basidiocarps and the colour of the spore print. If not otherwise stated the lamellae are neither interveined nor forked, the lamellar edge concolorous with or slightly paler than the sides, the context is not gelatinized, pleuro- and pileocystidia are absent and the cheilocystidia are thin-walled and hyaline, the tramal hyphae thin-walled and non-gelatinized.

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[1] The previous parts in this series are: 1. Introduction(in *Arq. Biol. Tecnol*. 35: 623-629. 1992; 2. Myxomycetes (in: *Arq. Biol. Tecnol*. 35: 631-633. 1992); 3. Stipitate Hydnums (in *Arq. Biol. Tecnol.* 35: 635-640. 1992); 4. The psychoactive species (in *Arq. Biol. Tecnol.* 36: 313-329. 1993); 5. Poroid and lamellate boletes (*Edinb. J. Bot.*, in press).

The microscopic structures were mainly observed in dried material. Fragments of lamellae were mounted in Congo red, heated and examined in 5% KOH. The structure of the pileipellis was examined in 10% ammonia or 5 % KOH. On species level the shape of the cheilocystidia and the texture of the pileipellis prooved to be important characters within the genus *Crepidotus*. In tropical and subtropical climates, however, these elements rapidly collapse and desintegrate. Therefore very young basidiocarps are needed in addition to mature ones for a correct identification.

The spore sizes are given with an approximation of 0.5 µm; they are based on 20 spores measurements per collection, Q is the length-width ratio of spores.

The bar equals 10 µm in all line drawings and 1 µm in the SEM pictures.

The SEM investigations were carried out with a JEOL JSM-T 300 using accelerating voltages between 10 and 15 KV. Air-dried spores were gold-coated for 3 minutes.

Colour codes refer to Kornerup & Wanscher (1978) and to Munsell (1975), names mainly to Kornerup & Wanscher (1978).

The terminology of vegetation types follows that of Veloso & Goés-Filho (1982).

The macroscopical descriptions are from the second author, while the first author is responsible for the microscopical examinations.The material is kept in the private herbarium of the the second author and parts of selected collections (BSI P97/1-97/13) are kept in Geneva (G).

RESULTS AND CONCLUSIONS

Spore ornamentation Figs. 1-3

Singer in all his contributions to *Crepidotus* described the spore ornamentation of section *Echinospori* as a very characteristic one: "spore walls as seen under oil immersion not homogenous but showing immersed heterogenous short and thin columns or narrow sheets of contrasting matter which cause the spore to appear faintly to strongly punctate when seen from above, circumference either smooth or, because of protruding ornamentation, verruculose to echinulate" (Singer 1973: 345). However, he assigns his spore ornamentation type XI to rugulose-verruculose spores (e.g. *C. subverrucisporus* in Singer 1973: 356) as well as to baculate spores (e.g. *C. crocophyllus* in Singer 1973: 370). SEM-studies show unequivocally that the spores of *Crepidotus* species reveal a striking variation of ornamentation types. Senn-Irlet (1994) distinguished five types, with the exception of the echinulate type of *C. cesatii*, all types were found in the Brazilian material.

(i) spores smooth (*C. mollis*-type)
  C. sublevisporus, C. antillarum, C. uber, C. albidus var. *boliviae, C. acanthosyrinus, C. epibryus*
(ii) spores rugulose-verruculose
  subtype 1: very faintly rugulose-verruculose (*C. versutus*-type)
    C. euterpicola, C. martini
  subtype 2: distinctly rugulose-verruculose (*C. luteolus*-type):
    C. catamarcae
(iii) spores verruculose
  subtype 1: isolated, rounded warts (*C. variabilis*-type):
    C. rubriceps
  subtype 2: isolated, rounded to baculate spores finely connected with basal ridges

C. palmarum
subtype 3: warts irregular, sometimes confluent, often decorated with small outgrowths (*C. carpaticus*-type)
C. croceitinctus, (including type collection) *C. quitensis*
(iv) spores baculate (*C. applanatus*-type)
C. truncatus, C. cystidiosus, C. aquosus

We regard spore ornamentation as an important character for species separation as well as for an infrageneric classification. Uppermost attention should be given to the observations in oil immersion: in most cases it is possible to distinguish rugulose-vermiculose types from baculate-echinulate ones. However, the distinction between echinulate, baculate and the strongly verruculose type with outgrowths lies beyond the optical boundaries of a light microscope.

Key to the Crepidotus species found in the state of Paraná

1 Spores smooth
2 Gelatinous layer with filamentous hyphae present in pileitrama and/or in gill trama; spores 6.5-9 x 4.5-6 µm, thick-walled
3 Clamp connections present; cheilocystidia long, clavate; pileipellis a cutis; spores 7.5-9.5 x 4.5-6 µm
3. C. antillarum
3* Clamp connections absent
4. Cheilocystidia narrowly lageniform; spores 6.5-9 x 4.8-6 µm, pielipellis with minutely incrusted hyphae and yellowish crooked cystidioid elements
1. C. sublevisporus
4* Cheilocystidia cylindrical to narrowly clavate, pileipellis a cutis of colourless hyphae; spores 7.5-9.5 x 4.5-6 µm
2. C. uber
2* Gelatinous layer absent; spores thick-walled or thin-walled
5 Clamp connections present (but very rare in *C. albidus*)
6 Basidiocarps white, cheilocystidia short, up to 27 µm long, flexuose; pileipellis a trichoderm ; spores 5.5-8 x 4.5-6 µm; pigment absent
14. C. albidus
6* Basidiocarps whitish to pale brown, cheilocystidia up to 65 µm long, narrowly clavate; pileipellis a cutis; spores 7.5-8 x 5-6.5 µm; pigment yellowish
15. C. acanthosyrinus
5* Clamp connections absent
7* Cheilocystidia whip-like, 27-40 x 4-6 x 1.8-2.5 µm, pileipellis a trichoderm; spores 6.5-8 x 2.5-3.5 µm **16. C. epibryus**
7* Cheilocystidia short, up to 27 µm long, flexuose; pileipellis a trichoderm; spores 5.5-8 x 4.5-6 µm (clamps at least at the base of basidia!)
14. C. albidus
1* Spores ornamented
8 Spores globose to subglobose, $Q < 1.26$, finely punctate
9 Spores small, 4-4.5 x 4-4.5 µm; cheilocystidia short, up to 26 µm long, with finger-like excrescenses **7. C. quitensis**
9* Spores larger, 5.5-8.5 x 4.5-7.0 µm
10. Spores perfectly globose, $Q = 1.0\text{-}1.05$, ornamentation baculate

11 Pleurocystidia present, pileus whitish
5. C. cystidiosus

11* Pleurocystidia absent; pileus light brown, greyish orange, yellowish orange; pigment in pileipellis parietal and finely incrusting

12. Cheilocystidia broadly clavate, capitate, 25-60 (-80) x 25 µm,; pileipellis with more or less distinct brownish fibrils

4. **C. truncatus**

12* Cheilocystidia cylindrical to narrowly clavate, strongly flexuose, sometimes branched or beaked, up to 70 µm long; pileus greyish orange, very pale brown; pileipellis a cutis with abundant erect narrowly lageniform tapering terminal cells; very thin fleshed

6. **C. aquosus**

10* Spores subglobose, Q = 1.0-1.25, with a suprahilar depression, ornamentation verruculose

13. Pleurocystidia present

8 a **C. croceitinctus var. cystidiophilus**

13 * Pleurocystidia absent

14. Pileus yellowish orange, orange yellow; cheilocystidia clavate to narrowly utriform; pileipellis a cutis with scattered pileocystidia and only towards the margin forming a trichoderm with cylindrical terminal cells

8. **C. croceitinctus**

14* Pileus sordid, fuscous-pallid, whitish-buff or whitish, strongly hygrophanous and translucently striate

9. **C. palmarum**

8* Spores not globose, Q >1.26, broadly ellipsoid, slightly amygdaloid, rugulose to verruculose

15. Pileus dark brown to brick red; cheilocystidia small, up to 30 µm long, broadly clavate to vesiculose 10. **C. rubriceps**

15* Pileus pale coloured or white; cheilocystidia longer, up to 50 µm

16. Pileus hygrophanous, strongly translucently striate, cheilocystidia cylindrical, narrowly clavate, sometimes subcapitate

11. **C. catamarcae**

16* Pileus not hygrophanous and not translucently striate, cheilocystidia cylindrical, sligthly flexuose, spores very faintly rugulose

17. Spores 5.5-9 x 3.5-5.2 µm

12. **C. martini**

17 * Spores 8-11 x 5-6 µm

13. **C. euterpicola**

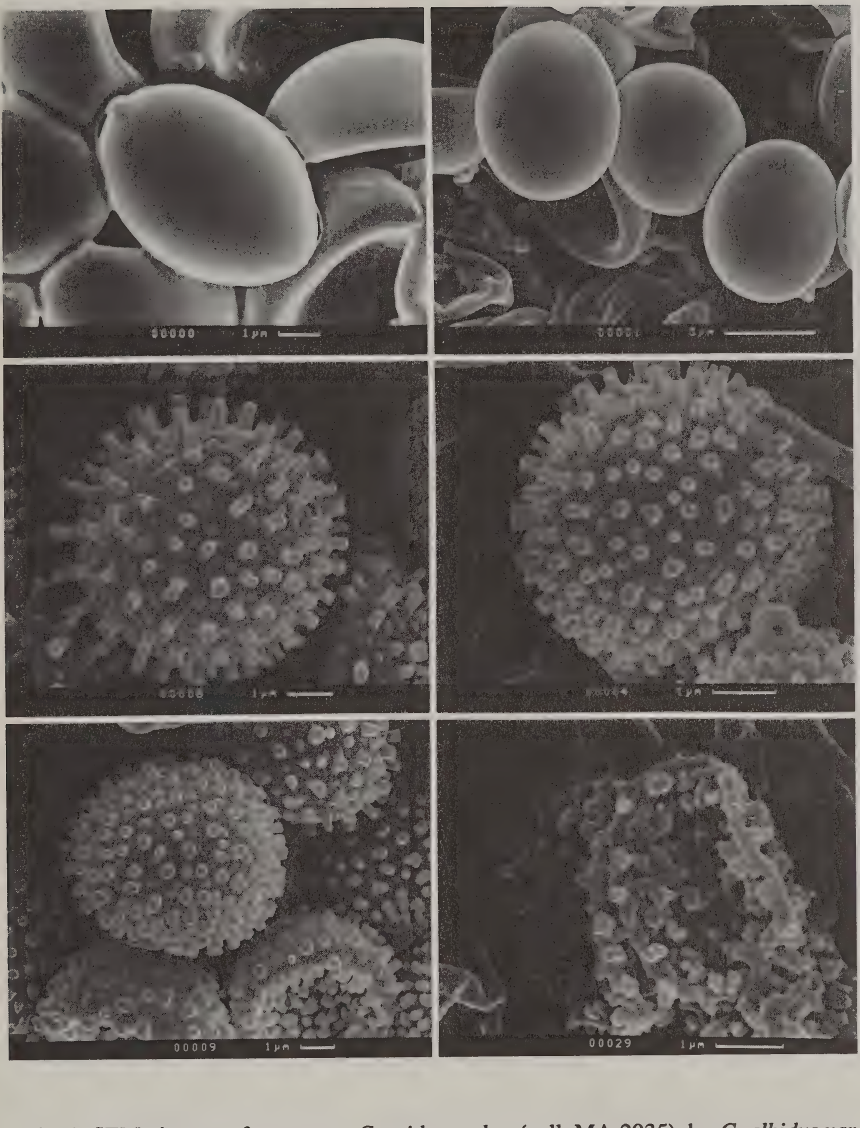
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Fig. 1. SEM pictures of spores. a - *Crepidotus uber* (coll. MA-2035), b - *C. albidus var. boliviae* (coll. CUa-2472), c - *C. truncatus*, (coll. MA-1917), d - *C. truncatus* (coll. MA-1046), e - *C. cystidiosus* (coll. CUb-2546), f - *C. quitensis* (coll. SM-1626).

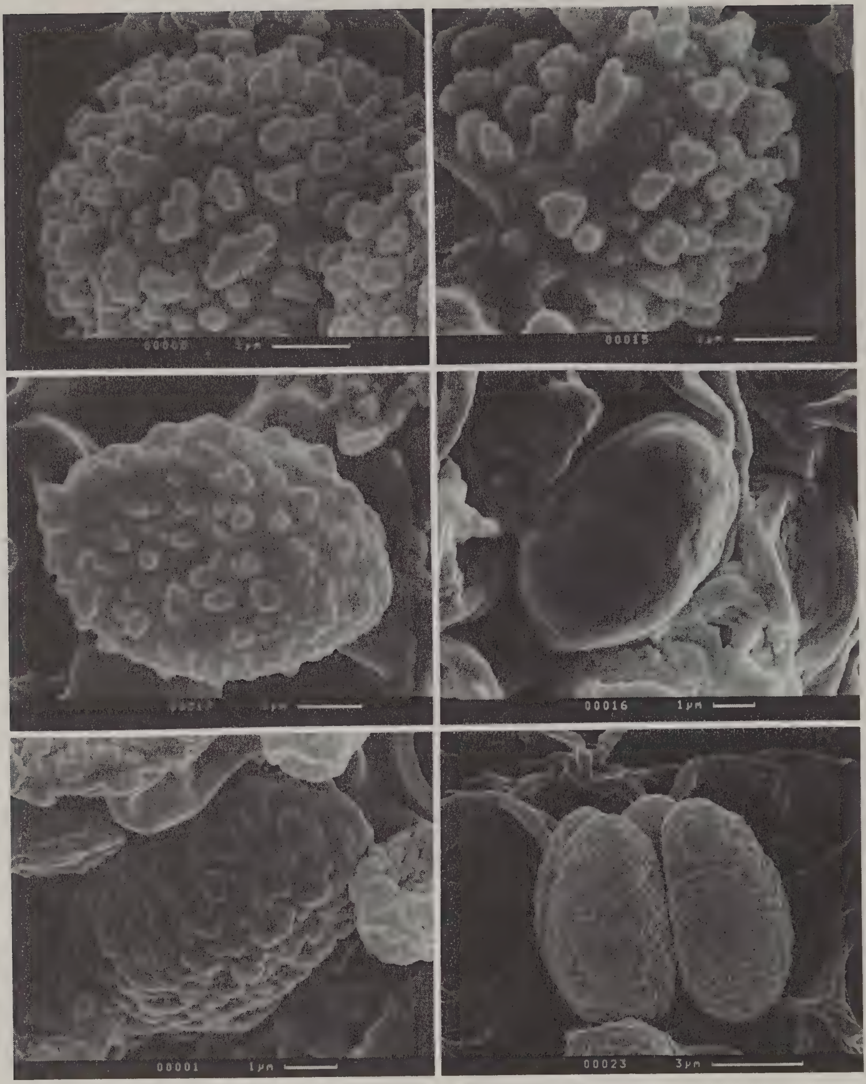
00015
00016 1µm
00001 1µm
00023 3µm

Fig. 2. SEM pictures of spores. a - *Crepidotus croceitinctus* (coll. MA-2068), b - *C. croceitinctus var. cystidiophilus* (coll. CUm-2149), c - *C. rubriceps* (coll. MA-2244), d - *C. euterpicola* (type, FE 3326), e - *C. catamarcae* (coll. GC-1425), f - *C. catamarcae* (coll. CUa-395).

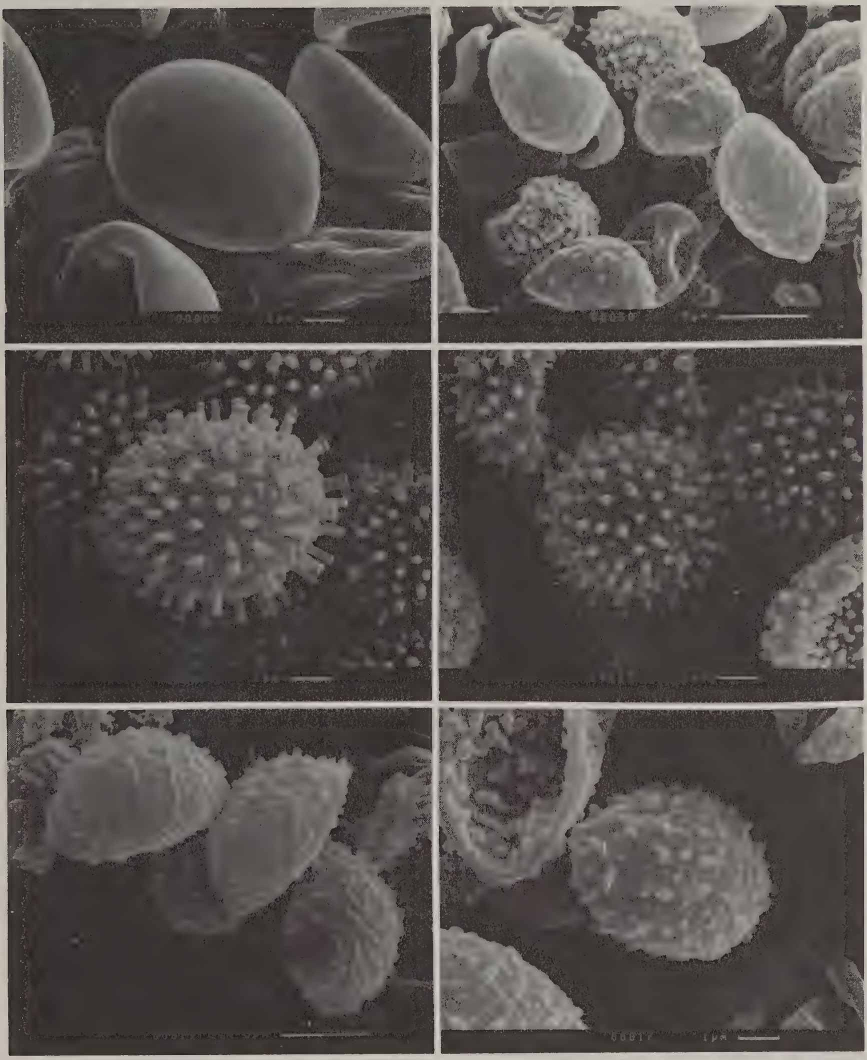

Fig. 3. SEM pictures of spores. a -*Crepidotus acanthosyrinus* (coll. DN-3374), b - *C. croceitinctus* (type collection), c - *C. aquosus* (coll. RSc-3127), d - *C. aquosus* (coll. ALa-3216), e and f - *C. palmarum* (coll. RSc-3125).

Descriptions of the species

I. *Crepidotus* subgenus *Crepidotus*

characteristics: spores smooth and thick-walled, trama of pileus made up of multi-branched, short-celled hyphae, gelatinous layer present; clamp-connections lacking.

The type species of this subgenus is *Crepidotus mollis*, a widespread species at least in temperate and boreal Europe and Northern America.

However, it is difficult to get a clear picture of the species - complex around *Crepidotus mollis* in the Americas. Hesler & Smith (1965) as well as Singer (1973) described several forms, varieties and species. *C. uber* is said to be the most common representative in the tropics, especially in South America (Singer 1973). Yet, complete descriptions are scarce and the variation of the different characters (width of gelatinous layer, distinctness of the stratification, shape of cheilocystidia, colour of the pilei) remains unknown. To faciliate a comparison with data from other collections, the observed morphological differences in the material from the state of Parana are summarized in Table 1.

Table 1: Morphological differences in four collections of Subsection *Defibulatini* Singer

	coll.CUb-2594	coll.CUa-192 b	coll. CUa-192c	coll.MA-2035
gelatinous layer in pileus	very thin indistinct	rather broad (1/3) rather distinct	very thin indistinct	very thin indistinct
gelatinous layer in subhymenium	present	?	present	present
yellow crooked pileocystidia	present	present	present	absent
gelatinous gill edge	present	present	?	absent
finely incrusting pigment	present	present	present	absent
spore size µm	7.0 x 5.0	7.3 x 5.4	8.0 x 5.5	7.8 x 5.5
broadness of pilei in mm	up to 9	4-13	5-15	15-50
broadness of lamellae in mm	up to 3	up to 2.2	up to 2	up to 7
species name	*sublevisporus*	*sublevisporus*	*sublevisporus*	*uber*

1. *Crepidotus sublevisporus* Singer in Singer & Digilio Fig. 4

Crepidotus sublevisporus Singer in Singer & Digilio in Lilloa 25: 410. 1951 (1952) (Type: LIL).
Selected description: Singer in Beih. Nova Hedwigia 44: 444. 1973.

Basidiocarps in twos to gregarious.
Pileus 4-33 mm broad and up to 23 mm wide, convex and later plane, reniform to conchate, with margin regular to wavy remaining strongly decurved or slightly incurved, hygrophanous, when fresh translucent-striate almost to centre, striae yellowish grey (4B2), between striae yellowish white (4A2), at margin pale yellow to yellow (2.5 YR8/5), drying pure white; surface smooth, as polished when fresh, dry, white pubescent at point of attachment, else glabrous. Lamellae (L = 15, l = 3-7) subclose to close, horizontal, up to 3 mm broad, adnexed, at first whitish, then very pale brown (10 YR7/3), finally light yellowish brown to brownish yellow (10 YR 6/4-5), with edge entire. Stipe absent, or with lateral 0.5 x 3 mm pseudostipe up to 1 mm long and 3 mm broad, only visible from below, white, surface pubescent. Flesh very thin to medium thin, with context up to 2.8 mm thick near substrate, up to 1 mm thick above midpoint

of lamellae, white, distinctly elastically. Odour fungoid. Taste completely mild. Spore print brown (6E6).

Spores 6.5-9.0 x 4.8-6 µm, Q = 1.3-1.6, mean volume 116 µm^3, broadly ellipsoid, smooth, walls strongly coloured, thick. Basidia 19-26 x 6-8 µm, four-spored, clampless. Cheilocystidia 20-43 x 3-6 µm, forming a sterile band, cylindrical, mixed with some narrowly lageniform, sometimes flexuose, angled or geniculate, of so-called hymenial and tramal origin, subterminal cells embedded in a gelatinous matrix. Pileipellis a cutis of 4-8 µm wide, cylindrical hyphae, sparsely covered by very thin up to 2 µm wide cylindrical hyphae with long undifferentiated ascending terminal cells; scattered clusters of short-celled yellowish, isoplerous hyphae with cylindrical and flexuose and knob-like or beak-like cystidioid terminal cells form the barely visible scales. Pileitrama in the upper part with filamentous, 2-3 µm wide hyphae embedded in a more or less distinct gelatinous matrix. Pigment minutely incrusting in some hyphae of the pileipellis, in addition intracellular in some terminal cells of pileipellis, yellowish or colourless. Clamp connections absent.

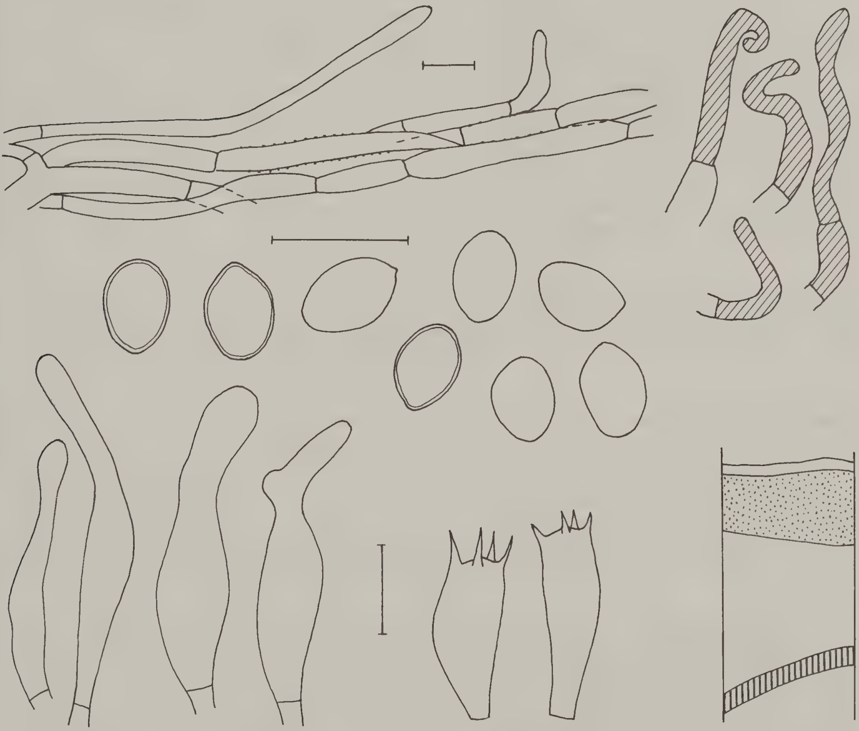

Fig. 4. *Crepidotus sublevisporus* (coll. CUa-192b) - pileipellis, spores, cheilocystidia, basidia, and pileocystidia, section through pileus with gelatinous layer.

Habitat: on dead dicotyledonous trunks and branches, in seasonal semi-deciduous alluvial forest and in mixed and dense ombrophilous forests, from 800 to 1000 m altitude.

Collections examined:
Curitiba, Reserva Biológica Cambuí, 9 June 1987 Meijer CUa-846 (ZT 4218); idem 2 March 1980, (coll. CUa-192b); idem 18 March 1980, (coll. CUa-192c, BSI P97/5); Curitiba, Parque Barigui, 21 March 1993 (coll. CUb-2594);

The thickness of the gelatinous layer varied much between the three collections: While two collection had a rather indistinct and very narrow gelatinous layer in the pileitrama and a similar gelatinous layer in the subhymenium, collection CUa-192b has a rather broad gelatinous layer in the pileitrama whereas we were not able to find one in the subhymenium (see table 1).

From observations on European collections of *C. mollis* the first author learned that the thickness of the gelatinous layer varies considerably between different collections. In the hymenophoral trama it is not always found. After rainfall the thin epicuticular hyphae may be washed off and then the gelatinous layer forms the uppermost part of the pileus, as it should be for *C. uber* sensu Singer (1973). We are convinced that besides presence or absence, no taxonomic status should be given to details of the gelatinous layer such as topography, and thickness.

The present South-American collections are not identical with European *C. mollis*, mainly because of the shape of the cystidioid terminal cells of epicuticular hyphae. The ranges of spore-size and spore-shape, however do not differ, neither do shape and size of the cheilocystidia.

For the time being we follow the concept of Singer (1973) and name our collections *C. sublevisporus*, despite the fact that Singer does not mention a gelatinous matrix. But he describes the presence of filamentous hyphae in the subhymenium and in the upper layer of the pileitrama.

2. *Crepidotus uber* (B. & C.) Sacc. Figs. 5, 1a

Agaricus uber B. & C. in Proceed. Amer. Acad. Arts Sci. 4: 117. 1860. (Type: K) - *Crepidotus uber* (B. & C.) Sacc., Syll. Fung. 5: 878. 1877.

Basidiocarps gregarious.
Pileus 15-50 mm broad, reniform to flabelliform, convex to plano-convex, with inflexed margin, becoming straight, already dry and astriate when collected but probably hygrophanous, smooth, glabrous, cream, ochraceous buff, in dried specimens surface radially wrinkled-sulcate. Lamellae crowded, narrow, up to 7 mm broad, subventricose to linear, narrowly adnexed to free, whitish cream to brown (7E5); edge even, sometimes paler. Stipe none. Flesh very thin (context up to 1 mm broad above midpoint of lamellae) to medium fleshy, context pure white when dry. Odour none.

Spores 7-9 x 5-6 µm, Q = 1.25-1.6, mean volume 124 µm^3, broadly ellipsoid, in side view slightly flattened, apex rather thin but without obvious pore, smooth, walls strongly coloured, thick. Basidia 18-22 x 5-9 µm, two- to four-spored, clampless. Cheilocystidia 15-43 x 4-6 µm, cylindrical, rarely very narrowly lageniform, tramal. Pileipellis a cutis of filamentous, 2-3 µm wide cylindrical hyphae with undifferentiated ascending terminal cells. Subpellis of rather short-celled 6-18 µm wide hyphae, gradually changing to the pileitrama with up to 12-28 µm wide, short, cylindrical cells and branched elements which form a loose jig-jaw like structure. Pigment lacking. Gill trama towards the subhymenium of narrow, rather loosely arranged, sligthly gelatinized, long-celled filiform hyphae and in the central part of short-celled, much wider hyphae, tending to form a jig-jaw like structure. Clamp-connections lacking, but pseudoclamps, i.e short appendices in the direction of the hyphae at the septae are present especially in the pileitrama.

Habitat: on decayed dicotyledonous trunk in dense ombrophilous forest, at ca 1000 m altitude.

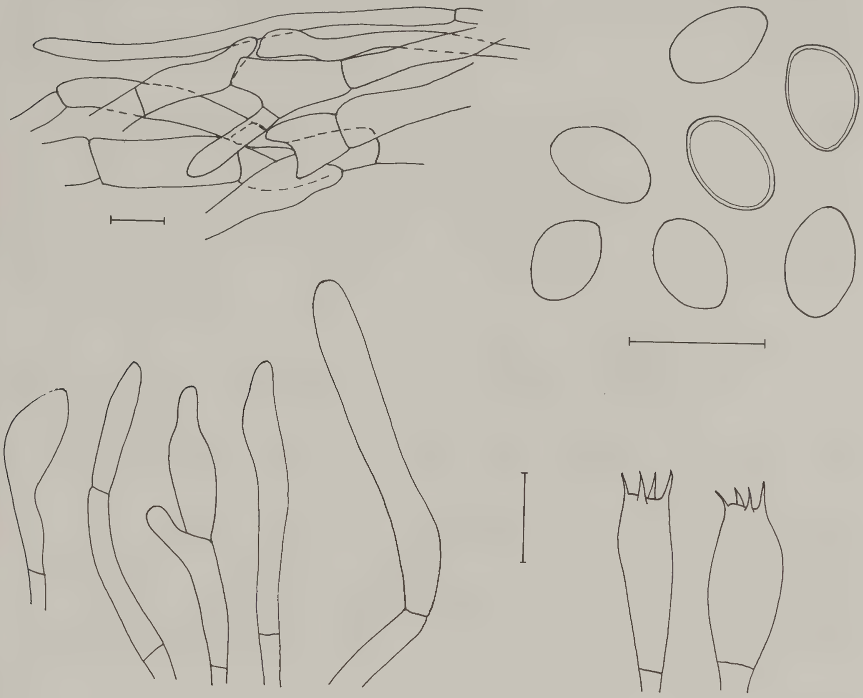

Fig. 5. *Crepidotus uber* (coll. MA-2035)- pileipellis, spores, cheilocystidia, and basidia.

Collection examined:
Parque Marumbi, Campina Grande do Sul, 10 November 1991, (coll. MA-2035, BSI P97/11), Quatro Barras Anhangava, 24 December 1994 (coll. MA-2986).

These collections exhibit several characters which are identical with the above described collections of *C. sublevisporus*

- size and form of spores
- size and form of cheilocystidia
- type of trama: loose, broad, rather short-celled hyphae

However there are also some important differences:

- no traces of scales on the pileipellis
- no traces of incrusting pigment
- no crooked yellowish cystidioid elements
- pileus and lamellae both broader.

Therefore we separate this collection from *C. sublevisporus* and name it *C. uber*

Crepidotus uber is interpreted by different authors in highly different ways. Singer, more recently (1973) considered the thickness of the gelatinous layer (very thick in *C. uber*) an important criterion, whilst in earlier days he emphasized on the distant lamellae (Singer 1947). For this author *C. uber* is devoid of a properly differentiated epicutis, while Hesler & Smith (1965) demand colorless epicuticular hyphae to separate it from *C. mollis* and other species. Pegler (1977) reports collections of *C. uber* which are completely devoid of a true gelatinous layer. Pilát (1951) describes the type of *C. uber* as a species similar to *C. mollis* but without (!) a gelatinous layer.

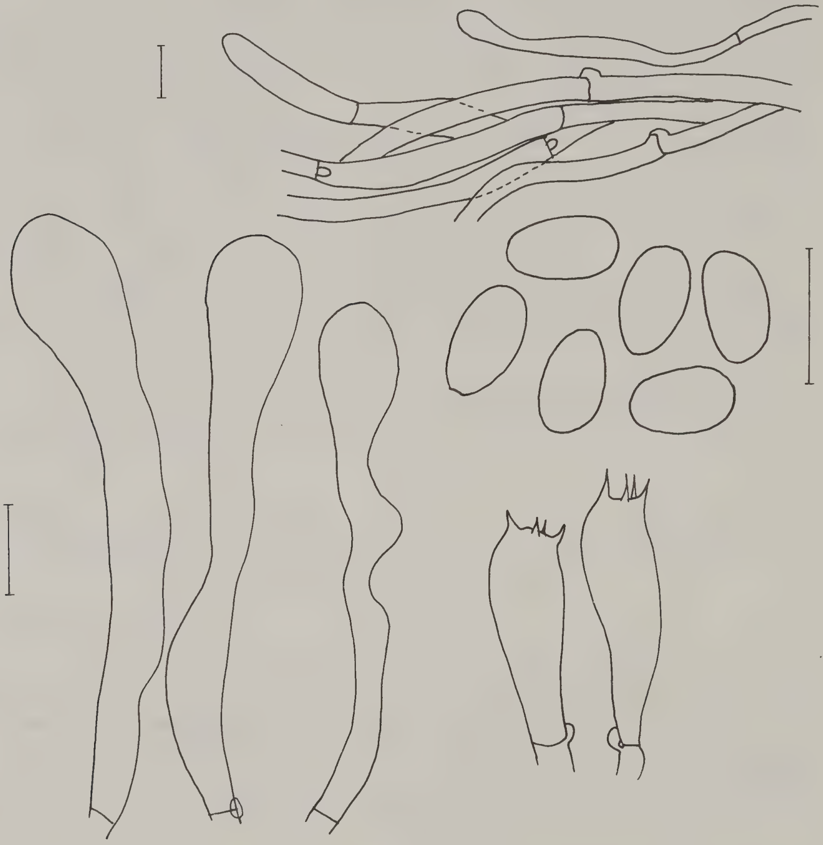

Fig. 6. *Crepidotus antillarum* (coll. CUa-403) - pileipellis, spores, cheilocystidia, and basidia.

3. *Crepidotus antillarum* (Pat. apud Duss) Singer Fig. 6

Tremellopsis antillarum Pat. apud Duss., Enum. champ. Guad.: 13. 1903. (Type: F?). - *Crepidotus antillarum* (Pat. apud Duss) Singer in Lilloa 13: 62. 1947.

Crepidotus chinchoensis Murr. in Mycologia 5: 30. 1913. (Type: FH).

Selected descriptions: Singer in Beih. Nova Hedwigia 44: 427. 1973; Hesler & Smith, North Am. Crepidotus: 103. 1965.

Basidiocarps solitary to gregarious.
Pileus 6-42 mm broad and up to 28 mm wide, conchate, plane, when fresh translucent-striate up to centre or only at extreme margin or up to centre, centre whitish or yellow to brownish yellow (10YR6.5/6) else yellow (10YR7.5/6, 2.5Y7.5/6), when dry astriate and white, entire surface white pubescent to silky, strongest so in centre. Lamelllae adnexed, close, horizontal, up to 6 mm broad, white later pinkish white (7.5YR8/2) finally pinkish brown. Stipe absent to lateral, up to 4 x 1.5 mm, white, surface pubescent.
Flesh rather thick, context up to 5.5 mm thick near substrate and up to 3.5 mm thick above midpoint of lamellae, when fresh yellow (5Y7/4), when dry white. Odour weak.
Spore print dark yellowish brown (10YR3/4).

Spores 7.5-9.5 x 4.5-6.0 µm, Q = 1.45-1.85, mean volume 132 µm^3, broadly ellipsoid to ellipsoid, ovoid, in side view slightly flattened, apex often rather thin-walled but never with an obvious pore, smooth; walls strongly coloured, thick. Basidia 20-30 x 7-9 µm, four-spored, clamped. Cheilocystidia 60-70 x 5-7 x 9-14 µm, clavate-capitate. Pileipellis a cutis of repent 2-5 µm wide strictly cylindrical hyphae; terminal cells undifferentiated, slightly ascending. Pileitrama of jig-jawlike cells; hyphae of the gelatinous layer 2 µm wide, flexuose. Lamellae with a very distinct gelatinous layer behind the subhymenium. Pigment yellowish, intracellular in pileipellis. Clamp-connections abundant.

Habitat: on dead dicotyledonous branches and twigs, in seasonal semi-deciduous alluvial forest and dense ombrophilous forest, from sea level to 900 m altitude.

Collections examined:
Curitiba, Reserva Biológica Cambuí, 4 March 1980 (coll. CUa-387); idem 20 March 1980 (coll. CUa-403); Parque Marumbi, Morretes, 25 December 1987 (coll. MA-1008, BSI P97/6).

Crepidotus antillarum is easily recognized by its large basidiocarps, its long clavate cheilocystidia with often capitate apex, the presence of abundant clamp-connections and otherwise with many characters of *C. mollis,* i.e. spore walls strongly coloured, smooth and thick, trama jig-jaw like, gelatinous layer present.

Crepidotus antillarum is unquestionably a member of the *C. mollis*-complex in spite of the abundant clamp connections, but unrelated to *C. albidus*, as proposed by Singer (1973) who puts both in the same small subsection (*Fibulatini)*.

II. *Crepidotus* subgenus *Dochmiopus* (Pat.) Pilát

Characteristics: Trama without gelatinous layer, trama of pileus not made up of short-celled, multibranched hyphae. Hymenophoral trama subregular. Spores mostly ornamented, rarely smooth. Clamp-connections present or absent.

II. 1. Section *Sphaerula* Hesler & Smith

Characteristics: Spores mainly globose or rarely oblong, verruculose, tuberculose, baculate or echinulate, basidiocarp white to red. Pileipellis a cutis of up to 10 µm wide cylindrical hyphae with scattered pileocystidia, often with finely incrusted segments. Pileipellis never a cuticle of repent hyphae bearing a turf of colorless straight or contorted narrow 2-4 µm wide hyphae.

4. *Crepidotus truncatus* Petch var. *truncatus* Figs. 7, 1 c-d

Crepidotus truncatus Petch in Ann. R. bot. Gdn Peradeniya 9: 226. 1924. (Type: K).
Selected description: Pilát in Trans. Br. mycol. Soc. 33: 235. 1951.

Basidiocarps solitary or gregarious.

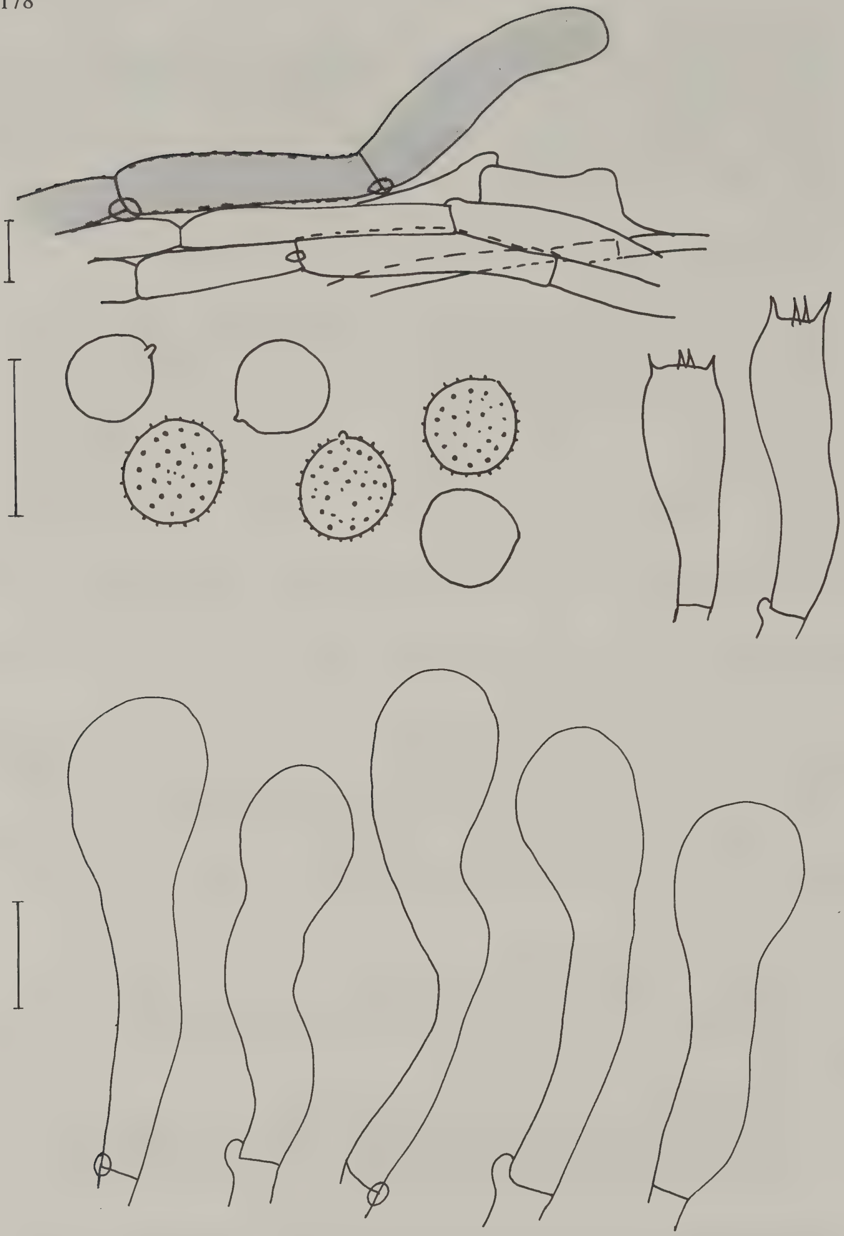

Fig. 7. *Crepidotus truncatus* (coll. MA-1917) - pileipellis, spores, cystidia, and basidia.

Pileus 20-52 mm broad and up to 35 mm wide, conchate to reniform, slightly convex becoming plane, strongly hygrophanous, when fresh translucently striate up to centre, striae greyish orange - brownish orange (5BC3), light brown (5D4) or brown (6E4), between striae brownish orange (6C3), greyish orange (5B4) or whitish, when dry astriate and pure white; surface smooth to slightly rough, dry, macroscopically glabrous, white downy near point of attachment. Lamellae close to subdistant, up to 6 mm broad, lanceolate, adnexed, first pure white, then brownish orange(5C4) to light brown/brown (6DE4) with smooth edge. Stipe absent.

Flesh with context thin, mostly up to 1 mm thick an base and up to 0.3 mm thick above midpoint of lamellae, sometimes (coll. 2989) up to 5 mm thick at base and up to 1 mm thick above midpoint of lamellae, greyish hyaline, drying pure white; sometimes near base in two distinct layers separated by a thin brown line. Odour fungoid to none. Taste mild. Spore print light brown to brown (6DE4).

Spores 5-6.5 x 5-6.5 µm, Q = 1-1.1, mean volume = 102 μm^3, globose, punctate, in optical section smooth to minutely spiny, with clearly visible episporium, thin-walled and moderately to faintly coloured. Basidia 24-29 x 7-9 µm, four-spored, clamped. Cheilocystidia 15-42 x 9-15 (-25) µm, clavate, to broadly clavate or broadly cylindrical, at times catenulate. Pileipellis a cutis of repent up to 10 µm wide cylindrical hyphae with scattered bundles of pileocystidia. Pigment yellowish, finely incrusting in segments (scales) of pileipellis, in pileocystidia also membranal. Clamp-connections abundant.

Habitat: on trunks or dead dicotyledonous trunks and branches, in dense ombrophilous forests, from 600 to 1100 m altitude.

Collections examined:
Parque Marumbi, 31 December 1987 (coll. MA-1046); idem 10 April 1991,(coll. MA-1917); idem, 11 December 1994 (coll. MA-2963), idem 27 July 1995 (coll. MA-3143, BSI P97/10); Quatro Barras, Anhangava, 24 December 1994 (coll. MA-2989); Jundiai do Sul, Fazenda Monte Verde, 4 February 1996 (coll. JSa-3250, BSI P97/1).

This species clearly is a member of the species-complex around *Crepidotus applanatus* with globose, baculate spores and clavate cheilocystidia and a pileipellis devoid of narrow, loosely arranged trichodermal hyphae .
In agreement with Singer (1973) we separate *C. truncatus* from *C. applanatus* only on account of the pileus colour, brown to at least pale brown versus white with argillaceous-greyish shades.

Especially in this group the cheilocystidia are quickly fading away, i.e they are easily dissolved and therefore it is often very difficult or impossible to find intact ones. The same holds true for basidia with well developed sterigmata. After spore release the sterigmata very rapidly dissolve and the basidia become more globose cells which stain deeply red in congo red.

5. *Crepidotus cystidiosus* Hesler & Smith Fig. 1e

Crepidotus cystidiosus Hesler & Smith North Americ. Crepidotus: 29.1965. (Type: MICH?).
Selected descriptions: Singer in Beih. Nova Hedwigia 44: 385. 1973, Natarajan & Raman in Nova Hedwigia 34: 176. 1981.

Basidocarps gregarious.
Pileus up to 60 mm, rounded flabelliform, convex becoming plano-convex, with margin narrowly inflexed, soon becoming straight, hygrophanous, translucently striate at margin, smooth to slightly sulcate, white becoming whitish cream, dingy cream, in dried specimen ochre-yellow or cream; point of attachment lateral. Lamellae moderately crowded, up to 4 mm broad, arcuate, subventricose, narrowly adnate, white, later pale

cinnamon, edge even. Stipe absent. Flesh very thin, up to 4 mm at point of attachment, white when faded, watery when fresh.
Spores 6-6.5 x 6 -6.5 µm, Q = 1-1.05, mean volume 114 μm^3, globose, minutely punctate, with clearly visible episporium, walls moderately coloured. Basidia 23 x 6 µm, four-spored, clamped. Cheilocystidia 20-28 x 7-11 µm, broadly clavate or obovoid, sometimes forked in the upper part and/or slightly flexuose. Pleurocystidia 29 -37 x 8-11µm, conical to narrowly lageniform with rather acute apex, thick-walled in upper part, with granular content. Pileipellis a cutis of repent hyphae. Pileitrama composed of rather loose, very broad hyphae. Clamp-connections present. Pigment absent.

Habitat: on earth wall, in mixed ombrophilous forest, at ca 900 m altitude.

Collection examined
Curitiba, Parque Barigui, 5 March 1993 (coll. CUb-2546).

This well dried single fruitbody gives the impression of an old specimen with a hymenium in a decomposing state, so it was extremely difficult to find a mature basidium with sterigmata, the majority of basidia are in the shape of broadly clavate basidioles. The large number of spores present allows us assume that these basidioles represent old basidia and not very young basidia. This is a phenomonon often observed in the *C. applanatus*- group.

The interpretation of the so-called pleurocystidia remains doubtful. Could these cells not represent abnormal one-spored basidia e.g. one-spored sclerobasidia or another abnormality? Singer (1973) found similar specimens and he also expresses his doubts about the interpretation as pleurocystidia. For him *C. cystidiosus* represents an abnormal form of *C. nephrodes*. Indeed the spore ornamentation as seen in SEM suggests a close relationship with species of the *C. applanatus*-group.

Finally we are not convinced about the presence of cheilocystidia in this collection. In this specimen all cells of the hymenium and the supposed lamellae edge stain deep red in congo red and it is very difficult to distinguish these broadly clavate cells - the supposed cheilocystidia - from basidioles. The slightly larger size and the scattered forked elements are the only hint for an interpretation as cheilocystidia. Because of these uncertainties we therefore renounce a taxonomic conclusion for *C. cystidiosus*.

6. *Crepidotus aquosus* Murr. Figs. 8, 3c-d

Crepidotus aquosus Murr. in Mycologia 5: 30. 1913. (Type: NY, not seen).

Crepidotus tucumanus Horak in Nova Hedwigia 8: 338. 1964. (fide Singer, 1973, Type. ZT).

Basidiocarps in twos.
Pileus up to 20 mm broad, conchate, rounded flabelliform, convex becoming plano-convex, with margin narrowly inflexed to involute, not hygrophanous but surface minutely striulate and felty under lens, soon translucently striate, greyish orange (5B4), dry. Lamellae rather narrow, up to 3 mm broad, narrowly adnexed, very close to crowded, pure white, drying to pale brown. Stipe reduced to a minute, lateral pseudostipe, 1 x 0.8 mm. Flesh concolorous with the surface, very thin; context up to 0.4 mm thick. Odour indistinct.

Spores, 5.0-6.5 x 5.0-6 µm, Q = 1-1.1; mean spore volume 90μm^3, globose, finely punctate, with clearly visible episporium, walls moderately coloured. Basidia 22-26 x 5-8 µm, four-spored, clamped. Cheilocystidia 39-62 x 6-8 µm, cylindrical to narrowly lageniform, strongly flexuose, often tapering, sometimes branched and/or angled. Pileipellis a rather loose cutis of repent 6-14 µm wide cylindrical hyphae giving rise to numerous cystidia-like, distinctly tapering and sometimes sligthly flexuose, 50-70 x 6-9

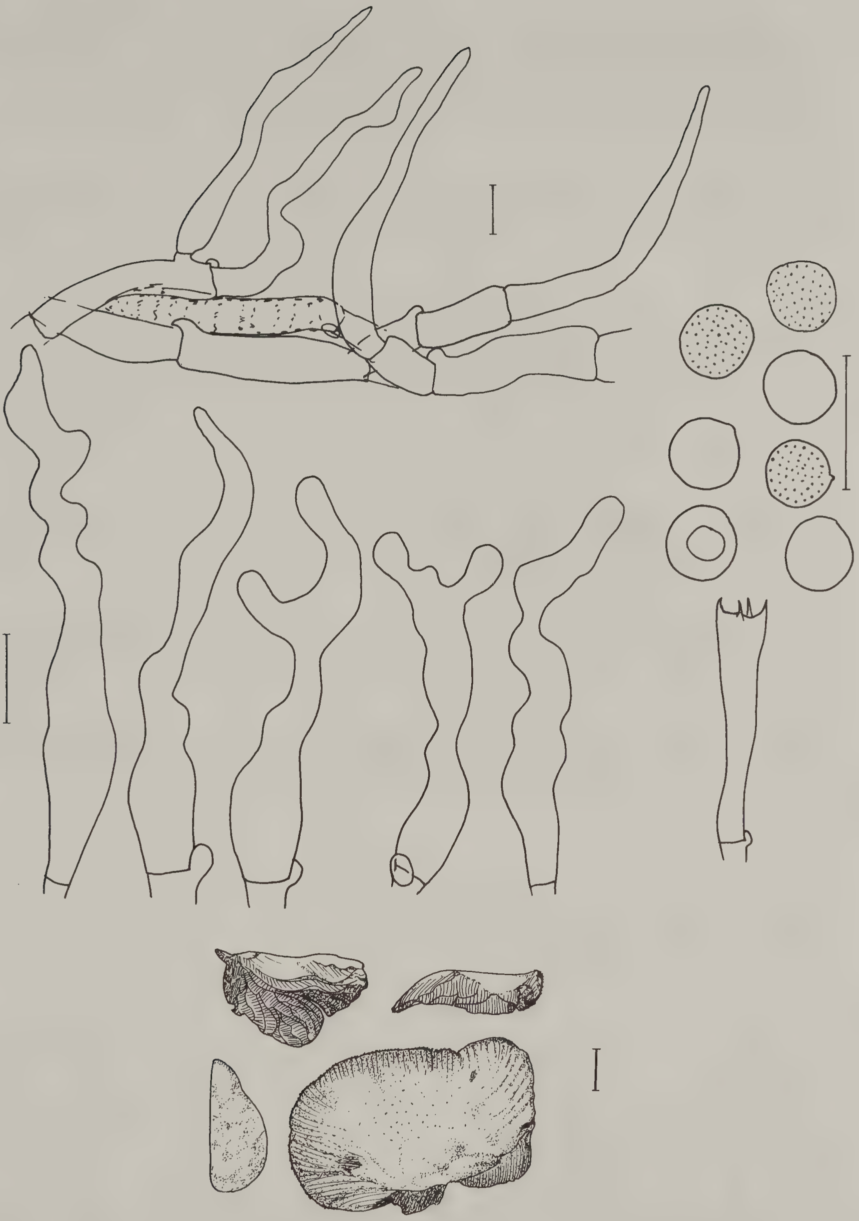

Fig. 8. *Crepidotus aquosus* (coll. Flb-2358) - pileipellis, spores, cheilocystidia, basidium, and basidiocarps.

µm terminal cells. Pigment pale brownish, parietal or minutely incrusting in the radiating hyphae of the pileipellis. Clamp-connections present.

Habitat: on decayed dicotyledonous wood, in seasonal semi-deciduous submontane forest, at ca 250 m altitude.

Collection examined:
Foz do Iguaçu, Refúgio Biológico Bela Vista, 15 October 1992 (coll. Flb-2358); Altonia, Estrada do Amendoim 2 km North of Jardim Paredao, 17 January 1995 (coll. ALa-3216); Rio Branco do Sul, 10 July 1995 (coll. RSc-3127, BSI P97/8); Diamante do Norte, Estaçao Ecologica do Caima, 18 March 1996 (coll. DN-3372).

A member of the *Crepidotus crocophyllus*-complex with baculate spore ornamentation and faintly coloured, very thin-fleshed pileus.

Singer (1973) described the pileipellis with membranal pigment only. At least one of our collections (coll. 2348) shows some finely but distinctly incrusted hyphae.

7. *Crepidotus quitensis* Pat. Figs. 9, 1f

Crepidotus quitensis Pat. in Bull. trimestr. Soc. mycol. Fr. 9: 129. 1893. (Type: FH).

Selected descriptions: Singer in Lilloa 25: 407. 1952 (1951) and in Beih. Nova Hedwigia 44: 362. 1973; Horak in Nova Hedwigia 8: 333-346. 1964; Pegler, Prelim. Agaric Flora East Africa: 513. 1977.

Basidiocarps gregarious.
Pileus up to 8 mm broad, white, becoming dirty pallid, with smooth surface. Lamellae close to crowded, 1.5 mm broad, pale greyish orange (6AB3). Stipe absent. Flesh very thin. Odour none.

Spores 4-4.5 x 4-4.5 µm, Q=1-1.1, mean volume 41 µm^3, globose, distinctly warty, indistinctly warty in optical section, with clearly visible episporium, moderately

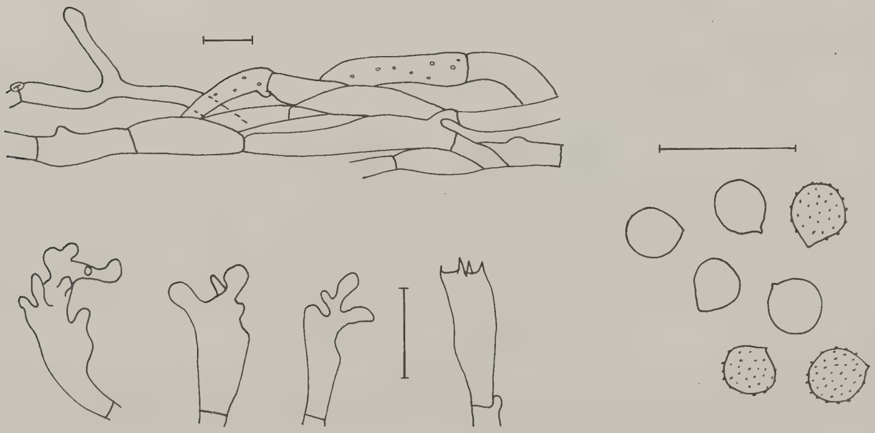

Fig. 9. *Crepidotus quitensis* (coll. SM-1626) - pileipellis, spores, cheilocystidia, and basidium.

coloured. Basidia 17 x 5 µm, four-spored, clamped. Cheilocystidia 17 - 26 x 5 - 8 µm (including outgrowths), clavate, narrowly utriform, with short finger-like up to 3 µm wide protuberances, which may be branched, angled or flexuose. Pileipellis a cutis of repent 3.5-4.5 µm wide cylindrical hyphae with scattered up to 20 x 2-3 µm excrescences; terminal cells undifferentiated, joining the cutis or slightly ascending. Pigment absent. Clamp-connections present but not very abundant.

Habitat: on dead dicotyledonous twigs, in mixed ombrophilous forest, at ca 800 m altitude.

Collection examined:
Sao Mateus do Sul, Fazenda Durgo, 20 April 1990, (coll. SM-1626).

According to Pegler (1977) who also examined the holotype, the species is recognized by the minute white pilei, the nodulose cheilocystidia and the very small spores. This exactly holds true for our fungus, a pantropical species.

It comes indeed very close to *C. carpaticus* Pilát (Syn: *C. harperi* Singer, *C. wakefieldiae* Pilát, see Senn-Irlet, 1992), with the same type of spore ornamentation also as seen in SEM, but differs mainly in smaller spores and very thin flesh.

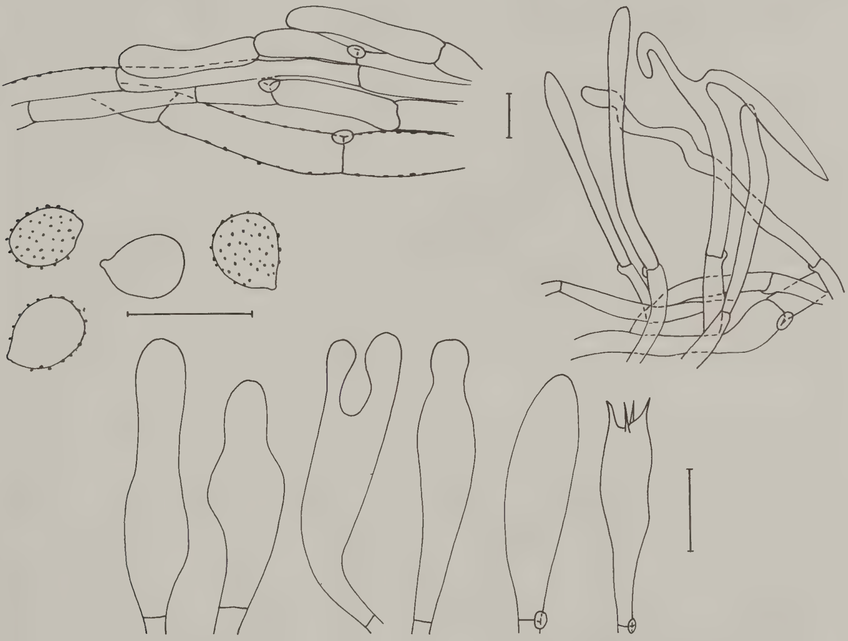

Fig. 10. *Crepidotus croceitinctus* var. *croceitinctus* (coll. TB-2296) - pileipellis in central part and rear, spores, cheilocystidia, and basidium.

8. *Crepidotus croceitinctus* Peck Figs. 10, 2a, b, 3b

Crepidotus croceitinctus Peck in New York State Mus. Nat. Hist. Rep 39: 72. 1886. (Type: NYS!).
Selected description: Singer in Beih. Nova Hedwigia 44: 392. 1973.

Basidiocarps densely gregarious.

Pileus 7-55 mm broad and 4-18 mm wide, hemispherical when seen from above, slightly convex in side view, hygrophanous, when fresh not translucently striate, first yellowish white (4A2) to pale yellowish orange (4.5A3), then light orange-yellow (4.5-5A 4-5), finally light orange (5A(B)4); surface smooth, dry, white pubescent to appressed tomentose in inner half towards point of attachment, in outer half minutely innately fibrillose. Lamellae very close to subclose-subdistant, ventricose or lanceolate, narrowly adnexed or free, up to 6 mm broad, hygrophanous, yellowish white (4A2) to pale yellow (4A3), soon greyish orange (5B(4-6)) to reddish orange (7B7), when dry light orange (5A4) to plae orange (5A3), edge slightly paler. Stipe absent or strongly reduced to 2 x 2 mm with dry tomentose surface, whitish. Flesh both at stipe and above midpoint of

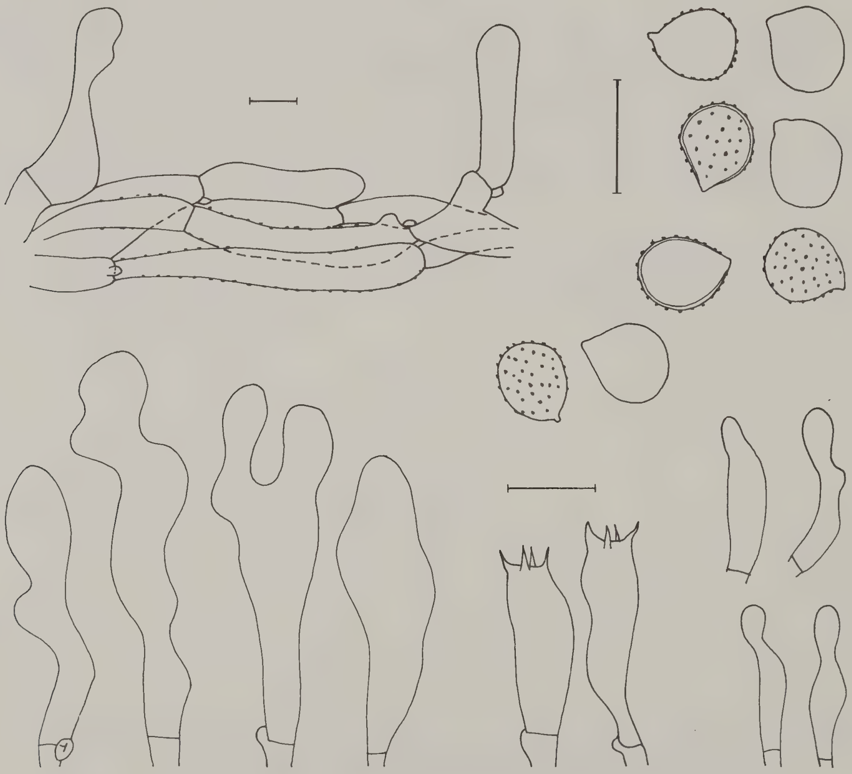

Fig. 11. *Crepidotus croceitinctus* var. *cystidiophilus* (coll. CUm-2149) - pileipellis in central part, spores, cheilocystidia, basidia, and pleurocystidia.

lamellae up to 4 mm thick, fresh yellowish grey (4B2-3) then white, near attachment separated in two layers by a narrow orange line. Odour weak to none. Taste completely mild. Spore print light brown, camel to fulvous (6D4).

Spores 5.5-7 x 4.5-6.5 µm, Q = 1.0-1.25, mean volume 110 µm^3, globose to subglobose, with a faint suprahilar depression, distinctly warty, with warts distinctly visible in optical section and with myxosporium; walls strongly coloured. Basidia 23-26 x 6-8 µm, four-spored, clamped. Cheilocystidia 26 -57 x 5 - 13 µm, rather variable in shape, narrowly clavate to narrowly utriform or cylindrical, flexuose, rarely branched. Pileipellis a cutis of repent 4-12 µm wide cylindrical hyphae with scattered 29-45 x 7-10 µm pileocystidia in the same variable shapes as the cheilocystidia, at rear a distinct trichoderm of erect 2-4 µm wide, sometimes branched hyphae, very distinct from the pileitrama. Pigment yellow-brownish, parietal or minutely incrusting in the pileipellis, intracellular in apical part of cheilocystidia. Clamp-connections present.

Habitat: on decayed twigs and branches of dicotyledons, on standing decaying dicotyledonous trunk, or one collection on rotten board of chipped wood; in dense ombrophilous forest and mixed ombrophilous forest, from 850 to 1200 m altitude.

Collections examined:
Parque Marumbi, Campina Grande do Sul, 13 December 1991 (coll. MA-2068); Curitiba, Bosque Reinhard Maack, 5 March 1993 (coll. CUm-2149); Telémaco Borba, Fazenda Klabin, 2 June 1992 (coll. TB-2296, BSI P97/7); Curitiba, Parque Barigui, 23 November 1994 (coll. CUa-2958, BSI P97/3); Reserva Biologica Cambui, 24 December 1995 (coll. Cua-3180).

In the field this species reminds somewhat *Phyllotopsis nidulans* (Pers.:Fr.) Sing., but differs distinctly in having less crowded lamellae.

Crepidotus croceitinctus belongs to stirps *Brunswickianus* sensu Singer (1973), characterized by somewhat elongated spores and lamellae with a yellow-orange, or salmon orange tinge. Spore size, shape of cheilocystidia and pileus colour separate the species. *C. subcroceitinctus* is yellow and has clearly ellipsoid spores (5.5-7 x 4.3-5 µm). *C. croceitinctus* is described by Hesler & Smith (1965) as well as by Singer (1973) with characteristic spores: a slight suprahilar depression is present and the ornamentation is very distinctly rough asperulate. However, the pilei of our collections display much stronger orange tinges than mentioned by these authors. In addition we found incrusting pigments. A critical re-examination of the type material, however, revealed also the presence of at least some minutely incrusted hyphae and the same type of spore ornamentation in the SEM.

Table 2. Parana collections of stirps *Brunswickianus* in comparison with the type collection of *Crepidotus croceitinctus* (* with SEM analysis of spores).

coll.	2958	2296	2068*	type*	2149 *
spore size in µm	5.9-7.7 x 5.0-6.6	5.6-7.0 x 4.7-6.6	6.4-7.3 x 5.6-6.5	5.8-7.4 x 4.7-5.9	5.6-7.1 x 4.6-6.0
spore-shape (Q-value)	1.0-1.32	1-1.27	1-1.23	1.1-1.4	1.1-1.28
cheilocystidia size (µm)	37-42 x 4-10	26-48 x 5-9	38-57 x 9-13	30-40 x 6-9	30-46 x 5-10
shape of cheilocystidia	ampullaceous	cylindrical, narrowly lageniform	lageniform few ampullaceous	ampullaceous, some cylindrical	ampullaceous, some branched
pleurocystidia	absent	absent	absent	absent	present
species name	var. *croceitinctus*	var. *croceitinctus*	var. *croceitinctus*	var. *croceitinctus*	var. *cystidiophilus*

In collection CUm-2149 cystidioid elements of 15-22 x 3-5 µm were found in the close neighbourhood of the gill edge. These cystidioles are smaller than the cheilocystidia and of different shape. They are even smaller than basidia. Singer (1973) found similar cystidioles in various species and interprets them simply as abnormalities. As long as we accept *C. cystidiosus* as different from *C. truncatus*, then we accept coll. CUm-2149 as a different taxon. Therefore we propose a new variety for the collection with pleurocystidia:

8a Crepidotus croceitinctus var. **cystidiophilus** var. nov. Figs. 11, 2b
A var. croceitinctus differt lamellis cum pleurocystidiis cylindricis vel lageniformibus 15-22 x 3-5 µm. Holotypus no CUm-2149 in herbario A. de Meijer, Curitiba conservatur.

9. ***Crepidotus palmarum*** Singer in Singer & Digilio
Crepidotus palmarum Singer in Singer & Digilio in Lilloa 25: 406. 1951 (1952).
(Type: LIL). Figs. 12, 3e, f

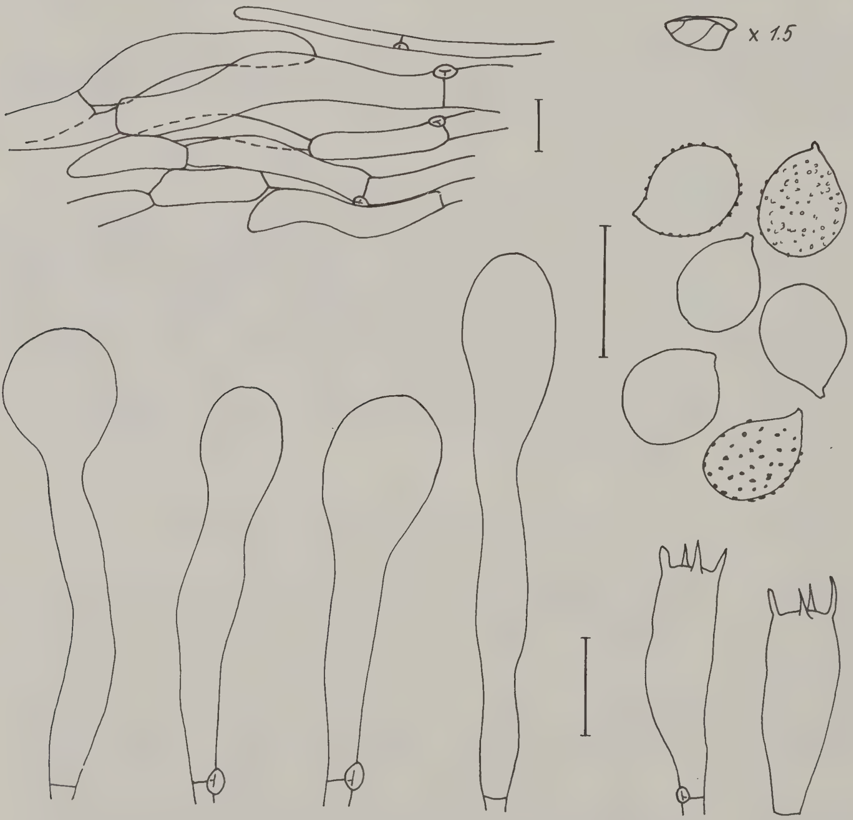

Fig. 12. *Crepidotus palmarum* (coll. RSc-3125) - pileipellis, spores, cheilocystidia and basidium.

Basidiocarps densely or loosely gregarious.
Pileus 2-15 mm broad, conchate, convex, hygrophanous, when fresh strongly translucent-striate up to 3/4; sordid, fuscous-pallid, whitish-buff; striae pale greyish orange between striae white, when dry astriate and whitish; surface smooth, dry, macroscopically glabrous. Lamellae free, subdistant, ventricose, up to 4.5 mm broad, greyish orange (5B4), edge pale. Stipe absent. Flesh very thin, context up to 1 mm thick at the base and up to 0.3 mm thick above midpoint of lamellae. Context concolorous with surface. Odour weak, fungoid. Taste mild. Spore print brownish orange (5C4).

Spores 6.5-8.5 x 5.5-7.0 µm, Q = 1.1-.1.26, mean volume 156 µm^3, almost globose to subglobose or broadly ellipsoid, mostly with faint suprahilar depression; ornamentation with strong, isolated warts (outline clearly visible in optical section); walls moderately coloured. Basidia 21-26 x 7-8 µm, four-spored, clamped. Cheilocystidia 37-50 (-80) x 5-7 x 10-12 (-20) µm, clavate-subcapitate to distinctly capitate. Pileipellis a narrow cutis of 2-4 µm wide repent hyphae with undifferentiated terminal cells. Clamp connections present in all tissues. Pigment lacking.

Habitat: on decayed leaf petiole of the palm *Syragus romanzoffiana* in mixed ombrophilous forest, at 900 m altitude.

Collections examined:
Rio Branco do Sul, 10 July 1995 (coll. RSc-3125, BSI P97/8).

A rather easy recognizable species with its characteristic substratum, the strongly, non-pigmented hygrophanous pileus and the subglobose spores.

Singer (1973) discusses the systematic position of *Crepidotus palmarum*. He hesitates between a placement within stirps *Brunswickianus* or stirps *Sphaerosporus*. Our observations clearly show that *C. palmarum* belongs to the stirps *Brunswickianus* due to the type of the spore ornamentation and the subglobose spore shape. The SEM picture (Fig. 3f) confirms this interpretation.

10. ***Crepidotus rubriceps*** **Singer** Figs. 13, 2c

Crepidotus rubriceps Singer in Beih. Nova Hedwigia 44: 480. 1973.
(Type: F).

Basidiocarps solitary to loosely gregarious.
Pileus 5- 23 mm broad, convex becoming plano-convex, with extreme margin remaining inflexed, not hyrophanous and young not translucently striate, only when old indistinctly striate up to half of the radius, when young dark brown (9E8), soon becoming reddish brown (8D8) to light brown or brick red (7D7), between striae paler, surface densely felty in centre, otherwise smooth, dry; in dried material distinctly felted. Lamellae (L = 16, l = 3-6), broadly adnexed to subdecurrent, subclose to subdistant, up to 5 mm broad, pure white, later pale ochraceous to greyish orange (B5 3.5). Stipe strongly excentric, 4-6 x 1.8-2.2 mm, cylindrical, solid, pale ochraceous; basal mycelium pure white; surface smooth and dry. Context pure white in stipe. Odour none.

Spores 5.5-7.5 x 3.5-4.5 µm, Q = 1.4-1.8, mean volume 59 µm^3, broadly ellipsoid, slightly amygdaliform with almost acute apex, with distinct suprahilar depression, and isolated strong warts (outline clearly visible in optical section); walls moderately coloured. Basidia 20-25 x 6-7 µm, four-spored, clamped. Cheilocystidia 12-23 (-41) x 8-12 µm, broadly clavate to vesiculose, apex rounded or subacute, often catenulate. Pileipellis a cutis with clusters (scales) of rather broad, 40-80 x 8-20 µm wide, broadly ellipsoid, thin-walled, red-brown elements with rather undifferentiated cylindrical terminal cells. Pigment red-brown, intracellular, clumping and in addition sometimes parietal. Clamp connections present in all tissues.

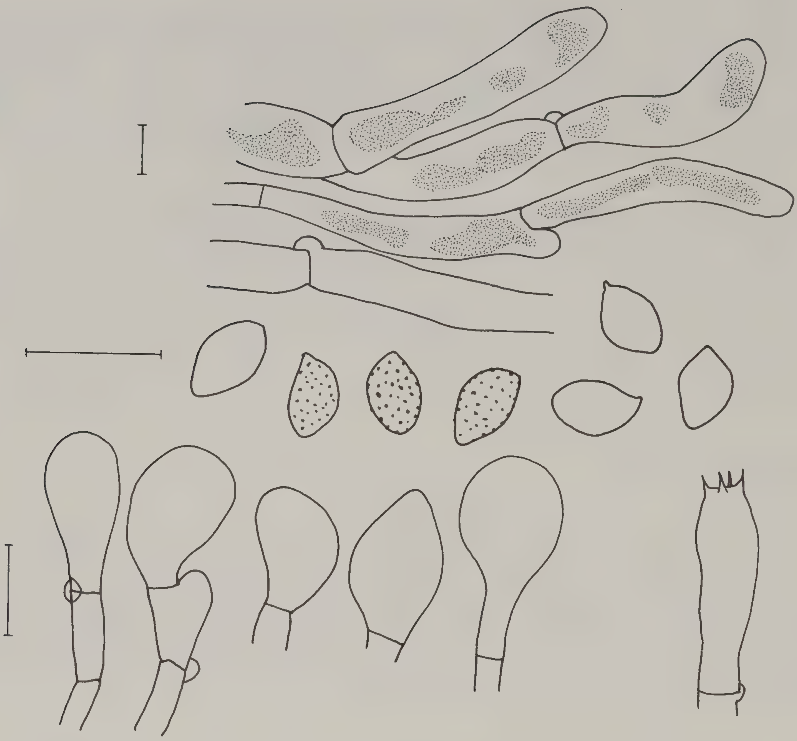

Fig. 13. *Crepidotus rubriceps* (coll. MA-2244) - pileipellis, spores, cheilocystidia, and basidium.

Habitat: on decayed twigs and branches of dicotyledons, in dense ombrophilous forest, from 300 to 500 m altitude.

Collections examined:
Parque Marumbi, Morretes, 10 April 1991 (coll. MA-1920, BSI P97/9); 11 April 1992 (coll. MA-2244).

Crepidotus rubiceps is easily recognized by its red-brown to brick red colour, the small mostly vesiculose cheilocystidia and the strongly warty, amygdaliform spores.

The type-locality of this beautiful species is located in Brazil.

II. 2. **Section Crepidotellae** Hesler & Smith 1965

characteristics: Spores always longer than broad, oblong, ellipsoid, ovoid-amygdaliform, smooth, rugulose or vermiculose; basidiocarps white or yellow.

II. 2.1 **Subsection Fibulatini** Singer 1947 emend. Senn-Irlet 1994

characteristics: Spores ellipsoid to oblong, ovoid or amygdaliform, ornamentation of spores rugulose or worm-like, with or without clamp-connections.

11. *Crepidotus catamarcae* Singer Figs. 14, 2e-f

Crepidotus catamarcae Singer in Beih. Nova Hedwigia 44: 478. 1973. (Type: F)

Basidiocarps gregarious.
Pileipellis 2-20 mm broad, conchate to reniform, convex, hygrophanous, when fresh translucently striate up to centre, buff (5C3), striae golden blonde, buff to clay buff (5C4), between the striae greyish orange)5B3), when dry astriate and whitish to buff; surface smooth to somewhat rugulose, dry, young almost completely white pubescent, later pubescent only around point of attachment. Lamellae (L = up to 9, l = 1-3) almost free, subclose to subdistant, up to 2.2 mm broad, at first white, becoming orange white, later avellanous to buff (5A2, 5B/C4, 7.5 YR 7/6). Stipe absent or lateral and 1 x 0.7 mm, white, pubescent. Flesh very thin, context up to 0.5 mm thick; context greyish white. Odour none. Spore print golden blonde, buff (5C4).

Spores 7-9.5 x 4-5.5 µm, Q = 1.5-1.9, mean volume 101 µm^3, ellipsoid, slightly amygdaliform but with apex rounded, finely verruculose ornamented, in SEM rugulose-verruculose; walls medium to faintly coloured. Basidia 22-26 x 5-7 µm, four-spored, clamped. Cheilocystidia 28-42 x 4-7 µm, cylindrical, slightly clavate or sometimes subcapitate to distinctly capitate, rarely somewhat flexuose. Pileipellis a cutis of 2-3 µm wide, cylindrical hyphae with undifferentiated tapering or obtuse terminal cells, mixed with some much broader ones up to 14 µm wide, finely incrusted hyphae. Pigment yellowish, minutely incrusting in pileipellis. Clamp-connections abundant.

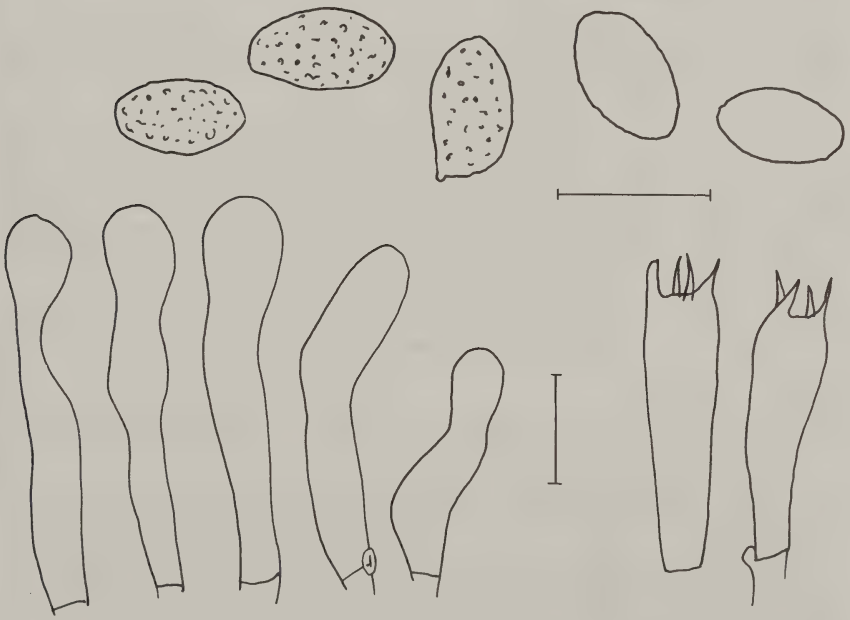

Fig. 14. *Crepidotus catamarcae*- (coll. CUa-395) - spores, cheilocystidia, and basidia.

Habitat: on dead dicotyledonous branches and twigs and at standing dead dicotyledonous trunk, in seasonal semi-deciduous alluvial forest and in dense ombrophilous forest, from 400 to 900 m altitude.

Collection examined:
Curitiba, Reserva Biológica Cambuí, 16 March 1980 (coll. CUa-395); General Carneiro, Fazenda São Pedro, 20 December 1989 (coll. GC-1425, BSI P97/12). Parque Marumbi, Morretes, 28 December 1994 (coll. MA-2991, MA-2992).

The microscopical analysis reveals a loosely woven tissue, an evanescent pileipellis, and spores and cheilocystidia which resemble in shape those of the *C. lundellii*, however with a slightly more pronounced spore ornamentation. No European species matches this character combination.

It is difficult to find a name from the Singer (1973) key. Stirps *Sphaerosporus* of subsection *Porpophorini* seems definitely inappropriate as the spore ornamentation type of our collections differs strongly from that of *C. cesatii (= C. sphaerosporus)*. However, Singer placed several species with most probably rugulose spores in that group.

12. *Crepidotus martini* Singer Fig. 15
Crepidotus martini Singer in Mycologia 47: 775. 1955.

Basidiocarps gregarious.

Pileus 2-8 mm broad, strongly convex, not hygrophanous, not striate, yellowish white (3A2) surface slightly uneven, dry. Lamellae subclose to subdistant, up to 0.8 mm broad, ventricose. Stipe absent. Odour indistinct. Context white when dry.

Spores 5.5-8.0 x 3.5-5.2 µm, Q = 1.4-1.9, mean volume 75 μm^3, ellipsoid, slightly amygdaliform in side view, almost smooth, finely verruculose-rugulose in SEM; walls moderately coloured. Basidia 20-28 x 7-8 µm, four-spored mixed with 2-spored, clamped. Cheilocystidia 35-45 x 3-6 µm, cylindrical to narrowly clavate, sligthly tapering or obtuse, often flexuose. Pileipellis a transition between a loose cutis and a trichoderm with straight 2-4 µm wide, colourless hyphae without differentiated terminal cells. Pileitrama rather loose. Pigment absent. Clamp-connections abundant.

Habitat: on dead dicotyledonous branch (*Eucalyptus* and others), in semideciduous submontane forest or in *Eucalyptus* plantation, between 250 and 350 m altitude.

Collection examined:
Fenix, Parque Estadual de Vila Rica do Espirito Santo, 25 Feburary 1996 (coll. FE-3311), Altonia, forest at Estrada do Mendoim, 2 km North of Jardim Paredao, 17 January 1996, (coll. ALa-3215).

A typical member of section *Crepidotellae* Hesler & Smith with ellipsoid, verruculose spores, a loose trichodermal cutis and lacking pigments. It is not an European species. It differs from *C. catamarcae* in fainter spore ornamentation, greater variation in cheilocystidia shape with capitate, branched and beak-like forms. This section needs a critical examination of the variability of its members. What is the variability of the spore ornamentation, what the range of the cheilocystidia patterns? It seems as if tropical and subtropical species exhibit a larger variability in all these characters than species of temperate zones.

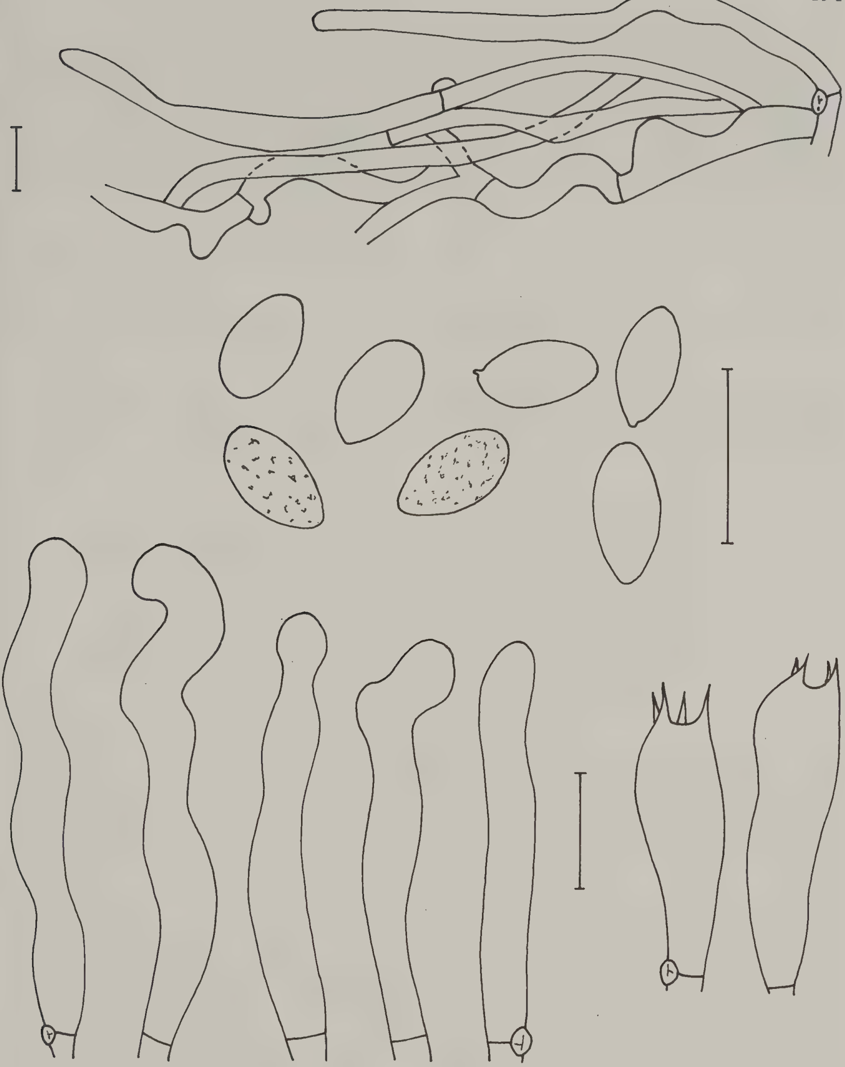

Fig. 15. *C. martini* (coll. ALa-3215) - pileipellis, spores, cheilocystidia, basidia.

13. ***Crepidotus euterpicola*** spec. nov. Fig. 16, 2d

Pileus 2.5-4 mm latus, sessilis, flabelliformis, albus, glabrosus. Lamellae confertae, albae deinde alutaceae. Sporae 8-11 x 5-6.5 µm ellipsoideae, minutule rugulosae, saepe subleves. Basidia 21-26 x 6-7.5µm, di et tetrasporae. Pleurocystidia desunt, cheilocystidia 28-55 x 4.5-6 µm, cylindrica, flexuosa. Cuticula ex hyphis repentibus composita, hyphas erectas sine colore gerens. Fibulatae adsunt.
Holotypus in herbario A. de Meijer, Curitiba conservatur, lectum in Fenix, Parque Estadual de Vila Rica do Espirito Santo, 27 February 1996, A. de Meijer coll. FE 3326.

Etymology: named after its substrate, the palm genus *Euterpe*.

Basidiocarps in threes.
Pileus 2.5-4 mm broad, semicircular, rounded flabelliform, strongly convex, margin slightly incurved, pure white, surface smooth and dry, white puberulous, strongly pubescent towards base. Lamellae subclose, up to 0.8 mm broad, pale becoming brownish orange (5C4), edge smooth. Stipe absent. Flesh thin, white. Odour none.

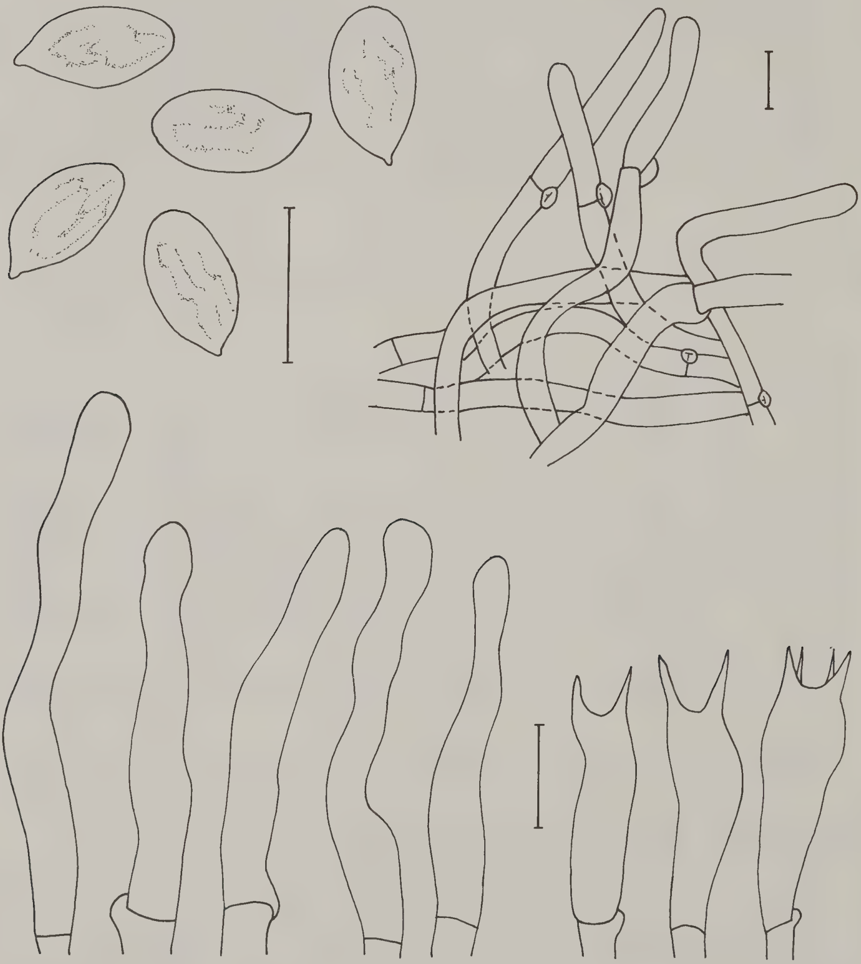

Fig. 16. *Crepidotus euterpicola* (coll. FE-3326)- cheilocystidia, spores, basidia, pileipellis.

Spores 8-11 x 5.2-6.5 µm, Q = 1.4-1.9, mean volume 170 μm^3, ellipsoid, slightly amygdaliform in side view, almost smooth, finely verruculose-rugulose in SEM; walls faintly coloured. Basidia 21-26 x 6-7.5 µm, dominantly two-spored, mixed with some four-spored, clamped. Cheilocystidia 28-55 x 4.5-6 µm, cylindrical, flexuose, apex slightly tapering and rounded. Pileipellis a transition between a loose cutis and a trichoderm with straight 2-4 µm wide colourless hyphae without differentiated terminal cells. Pigment absent. Clamp-connections abundant.

Habitat: on dead leaf of the palm *Euterpe edulis*, in seasonal semi-deciduous submontane forest, at 300 m altitude.

Collection examined:
Fenix, Parque Estadual de Vila Rica do Espirito Santo, 27 February 1996, (coll. FE 3326, type, isotype BSI P97/13 in G).

This tiny species is characterized by its rather large amygdaliform spores, appearing almost smooth under light microscope. The cheilocystidia are typically cylindrical and often somewhat tapering which seems to be a distinctive feature of this species.

II.2.2. Subsection Autochthoni Senn-Irlet 1994

characteristics: Spores smooth, rather thick-walled; hyphae with clamp-connections.

14. *Crepidotus albidus var. boliviae* Singer Figs. 17, 1b.

Crepidotus albidus var. boliviae Singer in Beih. Nova Hedwigia 44: 478.1973. (Type: F).

Crepidotus albidus E. & E. in Philadelphia Acad. Nat. Sci. Proceed. 1894: 322. 1895. (Type. NYS).

Basidiocarps tiny to small, densely to loosely gregarious.
Pileus 2-11 mm broad, reniform, convex to plane, not distinctly hygrophanous, not translucently striate, pure white; surface entirely puberulous, later almost smooth, dry. Lamellae (L = up to 10, l = 3) close to subdistant, up to 1.7 mm broad, brownish orange, golden blonde (5-6C/D4) to yellowish brown, clay and brown (5D5, 6E4), with white edge. Stipe completely absent. Flesh very thin. Odour none. Spore print brown (6E4).

Spores 5.5-8.0 x 4.5-6.0 µm, Q = 1.2-1.4, mean volume 95 μm^3, subglobose to broadly ellipsoid, with suprahilar depression, smooth, walls rather strongly coloured and rather thick. Basidia four-spored, clamped. Cheilocystidia 17-27 x 3-5 µm, cylindrical or narrowly lageniform and strongly flexuose, sometimes moniliform, rarely septate. Pileipellis near margin a distinct trichoderm with cystidioid, coiled terminal cells (see Fig. 17) towards the centre of the pileus a transition between a cutis and a trichoderm. Pigment lacking. Clamp-connections very rare, probably only at the base of the basidia (best seen in young basidia).

Habitat: on decayed dicotyledonous twigs or on decayed leaf petiole of the palm *Syragus romazoffiana*, in seasonal semi-deciduous alluvial forest, secundary mixed ombrophilous forest and dense ombrophilous forest, from 600 to 1000 m altitude.

Collections examined:
Curitiba, Reserva Biologica Cambuí, 20 February 1993 (coll. CUa-2472, BSI P97/4); Parque Marumbi, Antonina, 2 May 1981 (coll. MA-1974); idem Quatro Barras, 7 October 1987 (coll. MA-924); Rio Branco do Sul, Areias district, 11 February 1995 (coll. RSc-3012), Rio Branco do Sul, 10 July 1995 (coll. RSc-3126).

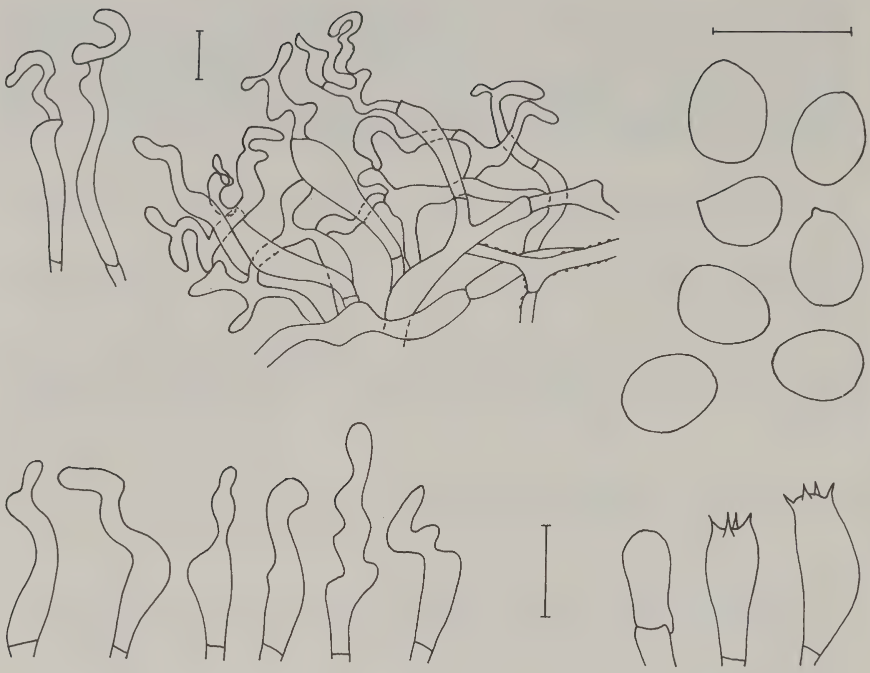

Fig. 17. *Crepidotus albidus* var. *boliviae* (coll. CUa-2572) - pileipellis with cystidioid cells, spores, cheilocystidia, basidia.

C. albidus var. boliviae is characterized by its rather small fruit-bodies, its short strongly flexuose cheilocystidia and the small, dark and smooth spores. Judged from the descriptions only (Singer 1973, Hesler & Smith 1965) their is no clear difference between the type species and var. *boliviae*.

15. ***Crepidotus acanthosyrinus*** Singer in Singer & Digilio Figs. 18, 3a

Crepidotus acanthosyrinus Singer in Sing. & Dig. in Lilloa 25: 411. 1952 (1951).(Type: LIL)

Selected descriptions: Raithelhuber, Hongos Argentinos:121, 1974. Singer in Beih. Nova Hedwigia 44: 436. 1973.

Basidiocarps dispersed to gregarious.

Pileus 5-15 mm broad, conchate, convex, with incurved margin, smooth and glabrous, at margin pubescent, dry, whitish to very pale brown (9YR8/4). Lamellae (L = 8, l = 1-2), close to subdistant, very pale brown (10YR7/4) finally snuff brown (6E4). Stipe lateral, up to 1.5 x 0.7 mm, only visible when seen from below, white pubescent. Context white when dry; odour indistinct. Spore print brown (6E4).

Spores 7.5-9.0 x 5.0-6.5 μm, Q = 1.3-1.7, mean volume 134 μm^3, broadly ellipsoid to ellipsoid, adaxially slightly flattened (side-view), smooth; walls strongly coloured, apically often thin-walled, but never with a distinct pore. Basidia 20-28 x 6-8 μm, four-spored. Cheilocystidia 36-65 x 4-6 μm, cylindrical to narrowly clavate, flexuose to slightly monilioid, with apex sometimes slightly capitate. Pileipellis a cutis of rather irregularly orientated, strongly interwoven, 3-6 µm wide hyphae, with rather thick-walled segments among normal undifferentiated ones, terminal cells rather undifferentiated, cystidia-like, with rounded or tapering ends. Pigment pale yellowish, intracellular, clumping or rarely minutely incrusting. Clamp-connections present, but not abundant.

Habitat: on decayed dicotyledonous twig and branch in seasonal semi-deciduous alluvial forest and semi-deciduous submontane forest, 300- 870 m altitude.

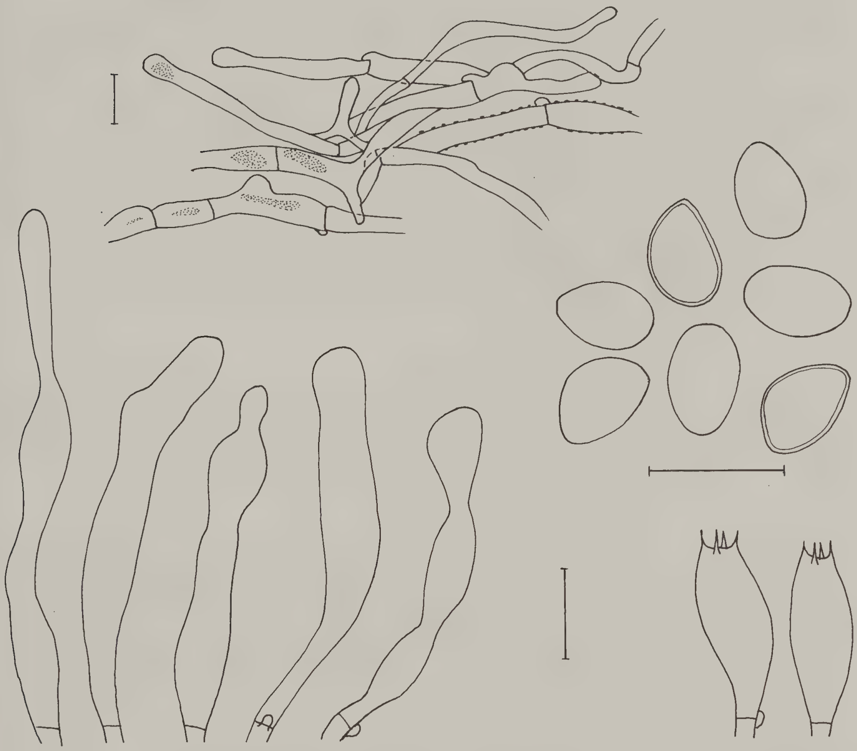

Fig. 18. *C. acanthosyrinus* (coll. CUa-142) - pileipellis, spores, cheilocystidia, basidia.

Collection examined:
Curitiba, Reserva Biologica Cambuí, 8 June 1987, Meijer CUa-844 (ZT 4220); idem 16 September 1979 (coll. CUa-142); Diamante do Norte, Estaçao Ecologica do Caiuá, 16 March 1996 (coll. DN-3374, BSI P97/14).

C. acanthosyrinus is characterized by its long rather cylindrical cheilocystidia, the smooth, thick-walled spores and the rather loose cutis.

Even if the spore-form and the thick spore-walls strongly resemble that of a species of subgenus *Crepidotus* (i.e. *C. mollis*-group), the absence of a gelatinous layer and the trama-type (regular to irregular) places *C. acanthosyrinus* in subgenus *Dochmiopus*.

II.2.3. **Subsectio Pleurotellus** (Fay.) Senn-Irlet 1994

Pleurotellus Fay. in Ann. Sci. nat. (Bot.) VII 9: 339. 1889 (basionym; type: *Pleurotellus graminicola* Fay. = *Crepidotus epibryus*).

characteristics: hyphae without clamp-connections; spores smooth or minutely rugulose, oblong to fusoid; fruit-bodies white.

16. ***Crepidotus epibryus*** (Fr: Fr.) Quél. Fig. 19

Agaricus epibryus Fr.:Fr., Syst. mycol. 1: 275.1821. - *Crepidotus epibryus* (Fr.:Fr.) Quél., Fl. mycol. France: 107. 1888. - *Dochmiopus epibryus* (Fr.:Fr.) Romagn. in Rev. Mycol. 2:137. 1937.- (Neotype: L).

Agaricus variabilis var. *hypnophilus* Pers., Mycol. eur. 3: 28, 1828. (Type: K).- *Agaricus hypnophilus* (Pers.) Berk., Outl. Brit. Fungol.: 139. 1860.-*Crepidotus hypnophilus* (Pers.) Norstein, Gen. Crepidotus Norway: 78. 1990.

Agaricus herbarum Peck in Bull. Buffalo Soc. nat. Sci. 1: 53, 1873. (Type: NYS).- *Crepidotus herbarum* (Peck) Sacc., Syll. Fung. 5: 888, 1887. -*Pleurotellus herbarum* (Peck) Sing. in Lilloa 13: 84, 1947.

Agaricus (Pleurotus) hypnophilus Berk., Outl. Br. Fungol: 39. 1860. -*Pleurotellus hypnophilus* (Berk.) Fay. in Ann. Sci. nat. (Bot). VII,9 :339. 1889. For more synonyms see Senn-Irlet (1994).

Selected icones.- Cooke, Ill. Brit. Fungi: pl. 516 C. 1885 (as *A. epibryus*.).

Basidiocarps gregarious.

Pileus up to 5 mm broad, semicircular, plano-convex, sessile, laterally or dorsally attached, with margin shortly inflexed later straight, mat, not hygrophanous, never striate, felted-tomentose, white, also when dried. Lamellae moderately crowded to crowded, well developed, narrow, arcuate to subventricose, narrowly adnexed, white, then pale ochraceous. Stipe absent.

Spores 6.5-8 x 2.5-3.5 µm, Q = 2.1-3.2, mean volume 38 μm^3, cylindrical to fusoid in frontal view, amygdaliform to distinctly pip-shaped in side view, smooth, faintly coloured, hyaline in light microscope. In preparation often in dyads and tetrads. Basidia 13-22 x 4-6 µm, four-spored, clampless. Cheilocystidia 27-40 x 4-6 x 1.8-2.5 µm, cylindrical, narrowly lageniform, whiplike, flexuous, often branched, hyaline, thin-walled. Pileipellis a transition between a cutis and a trichoderm of loosely interwoven or slightly coiled, cylindrical, 2-4 µm wide hyphae; terminal cells not differentiated, straight. Pigment none. Clamp-connections absent.

Habitat: on dead leaves of *Araucaria angustifolia* , on bamboo twigs or on decayed dicotyledonous twigs in mixed ombrophilous forest, at ca 900 m altitude.

Collection examined: General Carneiro, Fazenda São Pedro, 27 June 1989 (coll. GC-1299); Rio Branco do Sul, 10 July 1995 (coll. RSc-3128, BSI P97/2).

The collections are identical with European material of this white *Crepidotus* species with rather pale spores and narrow whip-like cheilocystidia.

Phenetic analysis

A phenetic analysis was performed in order to get an idea of the overall similarity of the investigated species. We, by no means, intend to interpret the result in a phylogenetic way, yet we take the result as a rather objective mean to test our ideas about the presented classification. In addition the phenogram obtained may help to highlight possible misidentifications and provide in this sense an aid for the user of the key.

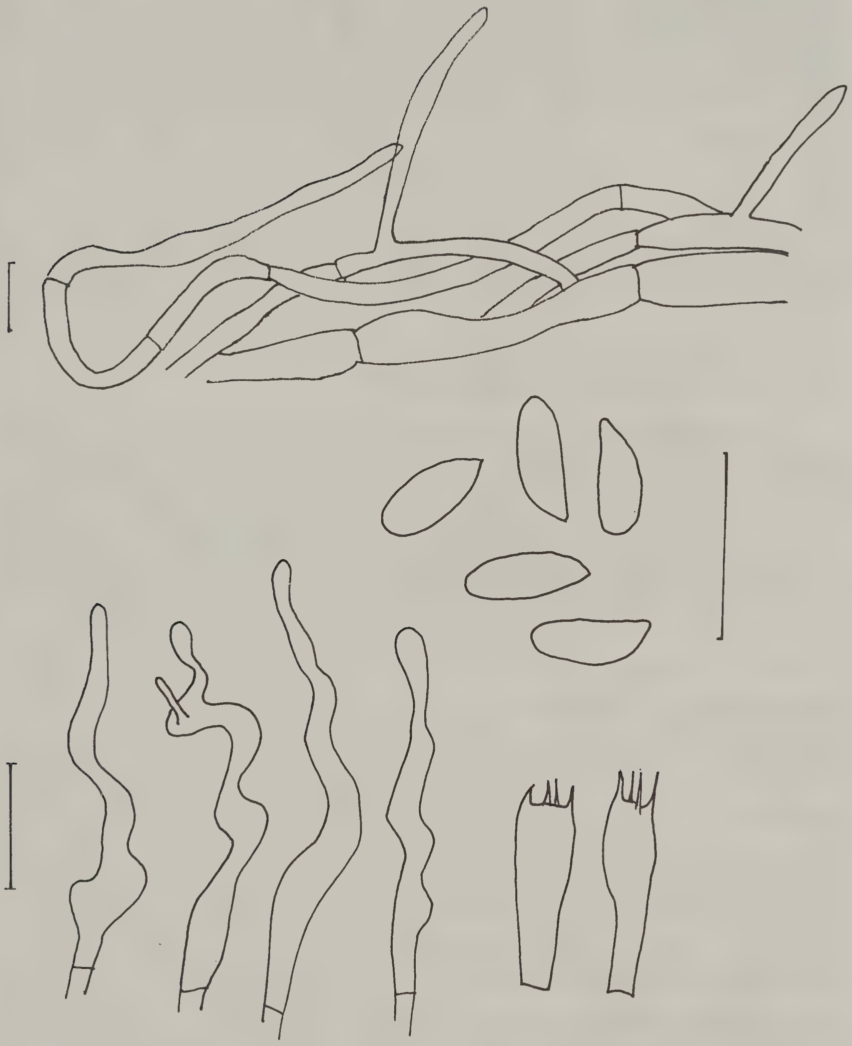

Fig. 19. *Crepidotus epibryus* (coll. GC-1299) - pileipellis, spores, cheilocystidia, basidia.

Table 2: Matrix of categorized morphological characters from 13 *Crepidotus* species.

	A	B	C	D	E	F	G	H	K	J	K	L	M
clamps present	0	0	1	1	1	1	1	1	1	1	1	1	0
gelatin. layer present	1	0	1	0	0	0	0	0	0	0	0	0	0
trama jig-jaw puzzle like	1	1	1	0	0	0	0	0	0	0	0	0	0
cap hygrophanous	1	0	0	0	1	1	0	0	0.5	0	1	0	0
cap white	0	1	1	1	1	0	0	1	1	1	0.5	0	1
cap yellow,brown	1	0	1	0	0	1	0	0.5	0	0	1	1	0
cap red	0	0	0	0	0	1	1	0	0	0	0	0	0
spores globose	0	0	0	1	1	1	0	0.5	0	0	0	1	0
spores ellipsoid	1	1	1	0	0	0	1	1	1	1	1	0	1
spores smooth	1	1	1	0	0	0	0	1	0	0	1	0	1
spores verruculose	0	0	0	0	1	1	1	0	1	1	0	0	0
spores baculate	0	0	0	1	0	0	0	0	0	0	0	1	0
pigment incrusted	0	0	0	0	1	1	0	0	0	0	0	1	1
pigment intracellular	0.5	0	0	0	0	1	0	0	0	0	0	0.5	0
pileipellis a trichoderm	0	0	0	0	0	0	1	0	0	0	1	1	0

A = *sublevisporus*, B = *uber*, C = *antillarum*, D = *truncatus*, E = *quitensis*, F = *croceitinctus*, G = *rubriceps* , H = *albidus*, I = *catamarcae* J = *martini*, K = *acanthosyrinus*, L = *aquosus*, M = *epibryus*.

The phenogram (Fig. 20) shows three distinct groups, which clearly reflect the proposed infrageneric classification: Group 1 with *Crepidotus sublevisporus*, *C. antillarum* and *C. uber* form form the subgenus *Crepidotus*. The species of subgenus *Dochmiopus* are divided in two distinct groups which correspond again to proposed sections: Group 2 includes section *Crepidotellae* (from *C. epibryus* to *C. rubriceps*) and group 3 includes section *Sphaerula* (with *C. aquosus* and *C. truncatus*). *Crepidotus albidus* and *C. acanthosyrinus* form the subsection *Autochthoni*, . Based on the given dataset this group cannot be separated from subsection *Pleurotellus* with *C. epibryus*.

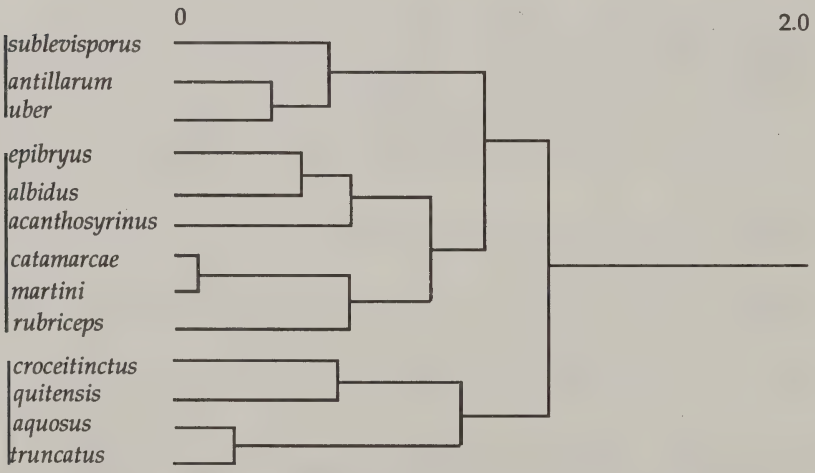

Fig. 20. Phenogram based on Pearson distance matrix and average linkage clustering.

Biogeographical notes

In our collecting area, the state of Paraná, most *Crepidotus* species are encountered exclusively in native forests, which concerns dense ombrophilous forest in the eastern part of the State, mixed ombrophilous forest with *Araucaria angustifolia* in the central and southern part and seasonal semi-deciduous forest in the northern and western portions and, in addition, along the larger rivers in other parts of the State. In Paraná extensive plantations of exotic trees are now encountered, mainly consisting of *Pinus* and *Eucalyptus* species, but these are uninteresting for Crepidoti, for on *Pinus* substrata no *Crepidotus* species were found and on *Eucalpytus* only two. The climate can be briefly characterized by high precipitation (> 1300 mm) and high to moderate temperature, eventually cooler in winter.

ACKNOWLEDGEMENTS

We thank the curator of NYS for the loan of type material, Guido Bieri and F. Zweili (Bern) for providing the SEM pictures, Margrit Kummer (Bern) for inking the figures and David Pegler (Kew) and Machiel Noordeloos (Leiden) for critically reading the manuscript.

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MYCOTAXON

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TULOSTOMA SUBSQUAMOSUM (GASTEROMYCETES), NEW FOR NORTH AMERICA

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ABSTRACT — The first record of *Tulostoma subsquamosum* in Mexico and North America is described. Photomicrographs of this material under LM and SEM are included.

Key words: Chorology, Gasteromycetes, taxonomy, *Tulostoma subsquamosum*.

INTRODUCTION

Tulostoma is a fungal genus very well represented in the Baja California peninsula, Mexico. In this territory there are extended arid and semiarid regions, to whose hard conditions these organisms are well adapted. There are several monographic papers on this genus in Mexico (Wright *et al.*, 1972; Guzmán *et al.*, 1972; Moreno *et al.*, 1995), and other papers contribute some additional records. In total, 26 species of *Tulostoma* are recorded from this country, 14 of them belonging to the mycoflora of the Baja California peninsula.

Continuing with our aim to gain a better knowledge of the diversity of fungi which inhabit this type of landscape, we present the record of *Tulostoma subsquamosum* Long & S.Ahmad in Baja California. Actually very few records of this species are known. It was first described from material originating in India (Long & Ahmad, 1947); later Wright (1987) and Calonge & Wright (1989) cited this species from Pakistan, Argentina, and Spain. Recently we made a revision of all this material (Altés *et al.*, 1996), including some Spanish collections which had been identified at first glance as *T. melanocyclum* Bres. By this way we could confirm the presence of *T. subsquamosum* in Spain, and show that the two species may easily be confused if the spore ornamentation is not studied under SEM. Considering this situation, the material described below is not only the first record of *T. subsquamosum* from Mexico, but also the first from the North American subcontinent.

MATERIAL AND METHODS

The only collection dealt with is deposited in the herbarium of the Facultad de Ciencias, Universidad Autónoma de Baja California, Ensenada, Mexico. There is a duplicate in the herbarium of the Universidad de Alcalá, Alcalá de Henares, Madrid, Spain.

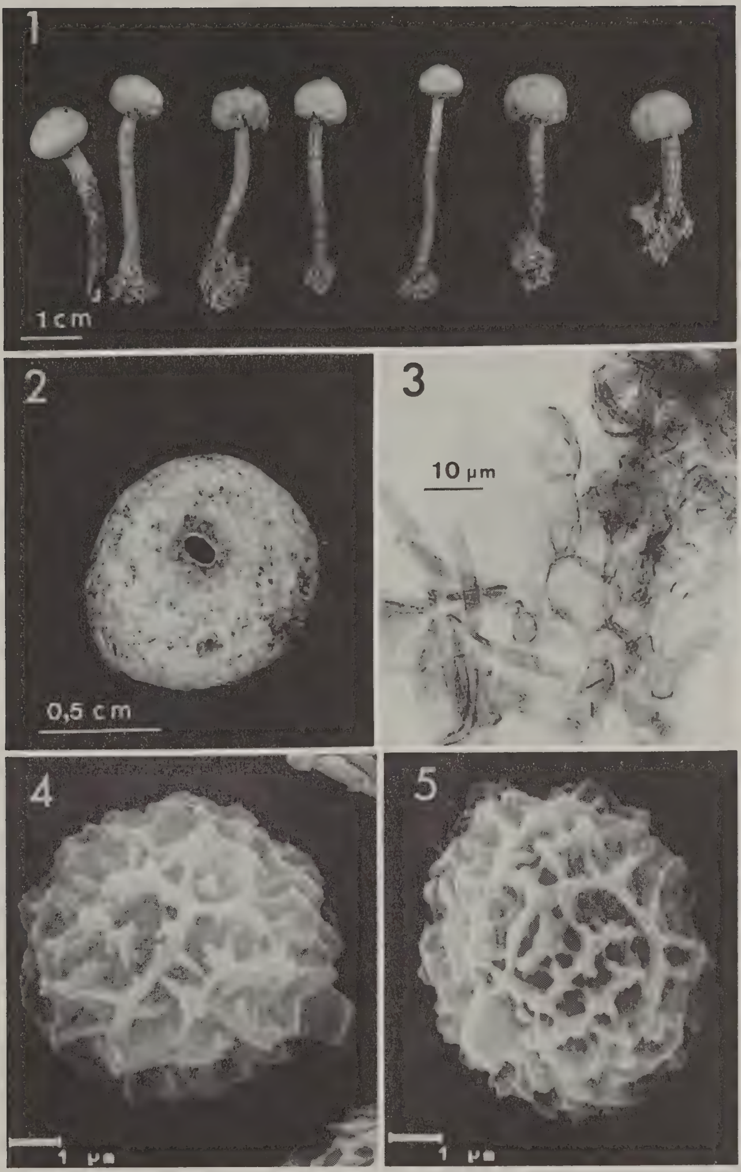
The study under SEM was made as indicated by Moreno *et al.* (1995). For the observation of the characteristic irregular cells in the exoperidium, preparations with ammoniacal Congo Red have been made.

Tulostoma subsquamosum Long & Ahmad, *Farlowia* 3: 241, 1947.
(Figs. 1-5)

Material studied: MEXICO: Baja California, km 78 Ensenada-San Felipe road, under *Juniperus californica* Carr., 20-IX-1995, *C. Ochoa*, BCMEX 5480 (duplo *in* AH 21504). INDIA: Gurdaspur distr., Jaggatpur, VIII-1938, *S. Ahmad 258* (BAFC, holotype).

The collection includes 7 complete basidiocarps, 27-40 mm long. Spore sac 7-10.5 mm diam., subglobose. Mouth circular, short tubular, about 1 mm diam., with a peristome varying from concolorous to markedly darker than the endoperidium. Exoperidium nearly completely vanished by erosion, remaining only small remnants mixed with particles of soil and sand which sometimes form a thin crust sticking to the endoperidium, particularly in the more basal zone of the spore sac. Endoperidium membranaceous, creame white, sometimes with ochraceous to coppery tints. Gleba ochraceous to ferrugineous (A3e). Stipe 18-35 x 2-3 mm, slender, cylindric, straight, striate, covered with dark brown scales, with the base somewhat inflated by the presence of mycelial remnants.

Spores 5.5-6.5 µm diam., globose to subglobose, pale ochraceous, with clearly verrucose and dense ornamentation. Under SEM the presence


1
1 cm
2
0,5 cm
3
10 µm
4
1 µm
5
1 µm

FIGS. 1-5. *Tulostoma subsquamosum* (AH 21504). 1: Basidiocarps. 2: Detail of a spore sac with tubular mouth. 3: Irregular cells of exoperidium. 4, 5: Spore ornamentation under SEM.

of anastomosing crests on the surface is visible, forming a characteristic dense subreticulum. Capillitium 3-8.5 µm diam., branched, thick-walled, with generally continuous lumen, subhyaline, septate, in variable degree inflated around the septa up to 12 µm diam., occasionally showing ochraceous colour. Exoperidium formed by hyphae mixed with cells of very variable size and form, sometimes in chains, similar to those described of *Tulostoma squamosum* Gmelin: Pers (Wright, 1987). Endoperidium formed by hyphae similar to the capillitium threads, 2.5-7 µm diam., branched, densely interwoven, thick-walled but with continuous lumen, subhyaline, inflated up to 9 µm diam. at the septa, where usually ochraceous pigmentation is present.

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MYCOTAXON

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AGARICUS SANTACATALINENSIS A NEW SPECIES FROM ARGENTINA.

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Abstract: *A. santacatalinensis*, found in exotic broadleaf woods in the environs of Buenos Aires, is described and illustrated. It belongs to subgenus *Lanagaricus* and is characterized by the chamois-like to velvety aspect of the pileus, the ochraceous yellowish color of the stipe with orange hues and detersile fibrils, and the centrifugally maturing process of the lamellae. A key to Argentinian species of the subgenus is proposed.

INTRODUCTION

During a survey of the species of *Agaricus* of Argentina, we recently collected some specimens which do not match any other known species and which we are herein proposing as a new species in the subgenus *Lanagaricus* Heinem. namely *A. santacatalinensis*.

The subgenus *Lanagaricus* as defined by Heinemann (1956) contains those species with a more abundan, thick, cottony general veil; detersile (sloughing off) fibrosquamules formed by usually cylindric elements, covering the pileus and the lower part of the stipe; partial veil membranous, often fragile; fruitbody usually stout; lamellae wide; colour variable, either bright or dark; flesh white, variable changing when exposed to air; odor never phenolic.

Freeman (1979) emended the concept of subgenus *Lanagaricus* originally proposed by Heinemann (1956). She considered that the degree of development of the general veil was very difficult to precisely ascertain and laid emphasis on the veil tissue type which she defined as cellular or hyphal type (Fremann, 1979: Fig. 1). She defined subgenus *Lanagaricus* as having a "cellular universal veil tissue; fruitbodies usually thin-fleshed, stature usually placomycetoid (pileus diameter divided by stipe lenght ratio less than one); stipe often bulbose; generally ocurring in woods". Freeman also omitted certain chemical tests (Shaeffer's reaction) since she considered these were of no value in that study specially when dry specimens were studied. As a result of this action, Freeman (*loc. cit.*) recorded 31 species for this subgenus (from a total of 42 studied) in her comprehensive study of the genus *Agaricus* in Southeastern United States, and considered such species as *A.placomyces* and *A.praeclaresquamosus* as belonging in that subgenus; these are now currently considered as belonging to Sec. *Xanthodermatei* of subgenus *Agaricus* (Heinemann 1986, Capelli, 1984). We believe that Heinemann's concept of subgenus *Lanagaricus* is more restricted. Not only the degree of development of the general veil, but also the presence of detersile fibrils of the pileus and lower part of the of stipe, should be taken into account. Heinemann in a later work placed on more weight these characters in a key to subgenus: "Voile général laineux, développé sur le chapeau et sur le stipe, sous lánneau, à éléments détersiles abondants; chapeau laineux ou squameux-laineux" (Heinemann, 1986).

Studies based on dry material provide only a partial information from which, in most cases, the features of fresh specimens cannot be inferred, and are thus of little use. If the keys constructed by former authors were based on these features, they may be almost useless for the identification of herbarium specimens. For example, detersile elements of both pileus and stipe, basic in the determination of species of subgenus *Lanagaricus*, are are easily lost in dried specimens. Unfortunately, it is not always possible to have at hand fresh material, which is indespensable for the study of species of

Agaricus. Identifications based exclusively on the features of dried material must be taken with caution.

MATERIAL AND METHODS

Shaeffer's macroscopic reaction was tested on fresh material. Microscopic examination of fruitbodies was undertaken mounting free-hand sections in 5% KOH and aqueous phloxine. Color names are in accordance with Maerz & Paul (1930). Names of authors taxa are according to Kirk & Ansell (1992). Herbarium abbreviations follow Holmgren *et al.* (1990). The slenderness index (IG) was calculated as described by Heinemann (1983). Specimens are deposited in BAFC Mycological Herbarium of the above department.

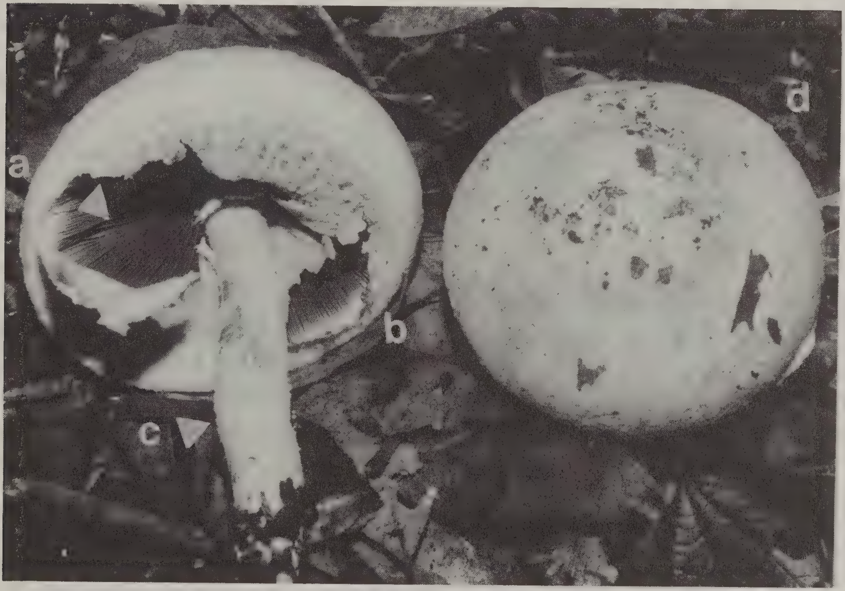

Fig. 1: ***A. santacatalinensis,*** General aspect (2X); a) Immature llamellae. Note the centrifugally maturing process evidenced by the whitish zone of the lamellae towards the margin. b) Squamulose partial veil; c) Stem with fibrils and detersile squamules; d) pileus view.

Agaricus santacatalinensis Albertó n. sp.

Pileo convexo, vel campanulato, flavo cremeo, ochraceo, squamulis densis concoloribus exornato, concentrici dispositis, parvulis densissimeque versus centrum. Lamellis, centrifugis maturantibus, primo flavo ochraceis, dein atrobrunneis. Stipe ochraceus, in partibus aurantiacus, subannulus cum squamulis secedentibus, rhizomorphae basalis concoloribus. Annulus pendulus, superus.

Sporis (4.5-)-5-5.50 x 3.5-4 *µm, ellipsoideis, brunneis, poro germinativo absens.Basidiis* 21-23 x 6-7 *µm tetrasporis. Cheilocystidiis* 14-35 x 14-20 *µm, pyriformis vel subglobosis.*

React. Schaeffer: vis, exigua, in exsiccata absens. Ad humus in sylvis sub Ligustri, gregariis. Odore et sapore amygdalino.

Holotypus: Argentina, Bonariae, Llavallol, Santa Catalina, leg. E. Albertó. 4-VI-1994, in Herb. BAFC 33.414 conservatus est; Isotypus idem BAFC 33.413.

Pileus 70-120 mm, convex to campanulate, creamish yellow to ochraceous (9 E2 a 9 E4), with small and dense concolorous concentrically arranged squamules which are smaller and denser in the centre and become longer and more spaced towards the margin; they define a somewhat coarse chamois-like surface (Fig. 1). Lamellae appressed, maturing centrifugally, at first ochre yellow (11 A2), finally dark brown (8 C3). **Stem** 85-120 x 15-20 mm, whitish from the union to the pileus up to the insertion of the ring, then ochraceous (10 C5) with orange hues (10 C7), fibrillose, with a farinose aspect, fistulose, with notorious fibrils or squamules begining from under the ring downward to the botton of the stem, easily separable upon touch, with short yellowish rhizomorphs. **Annulus** membranous 1-2 mm thick, large, hanging skirt-wise, superior, close to area of insertion of stem, farinose, with abundant squamules in its outer side, concolorous with stem. Context relatively thin, 3-5 mm thick, "flesh" scant, yellowish cream. Shaeffer's reaction slight in some specimens, negative in exsiccata. Aspect slender, IG: 4,63-6.21.

Spores (4.5-)5-5.50 x 3.5-4 µm, Q: 1.43 (n= 20), shortly ellipsoid, brown, without germ pore. Basidia 21-23 x 6-7 µm, 4-spored, clavate. Cheilocystidia 14-35 x 14-22 µm, pyriform to subglobose, abundant, in bouquets, making the border sterile. Pileus covering made up of appressed hyaline to brown, narrow, inflated hyphae 7-10 µm diam. (Fig.2).

Habitat: in exotic woods, among humus, gregarious under *Ligustrum* and *Ulmus*. Edibility unknown, smell very faint of almonds. Taste almond like.

Exsiccatum: Pileus light (11 E7). Lamellae brown without efflorescences. Stipe yellowish (9 H7), bulbous at the base with yelowish rhizomorphs. The annulus is very fragile and it is lost in many specimens. The detersile elements are mainly absent in dry material; these can be observed in collection BAFC 34.778

Material studied: BUENOS AIRES, Llavallol, Santa Catalina Mycological Reserve, leg. E. Albertó, 04-VI-94, Holotypus: BAFC 33.414; Isotypus: BAFC 33.413; Ibid. leg. ipse; BAFC 33.412; ibid., leg. ipse 26-X-95 BAFC 34.477; ibid., leg. BAFC 34.778.

REMARKS

A. santacatalinensis is characterized by the chamois-like to velvety aspect of the pileus in mature specimens, the ochraceous yellowish colour of the stipe, which has orange hues and the peculiar nature of the lamellae. These have, before maturation, a yellowish ochre color which upon ripening turns dark brown from the centre towards the margin (Fig. 1). This feature is probably due to habitat conditions but was, however, observed in specimens of three of the five collections studied.

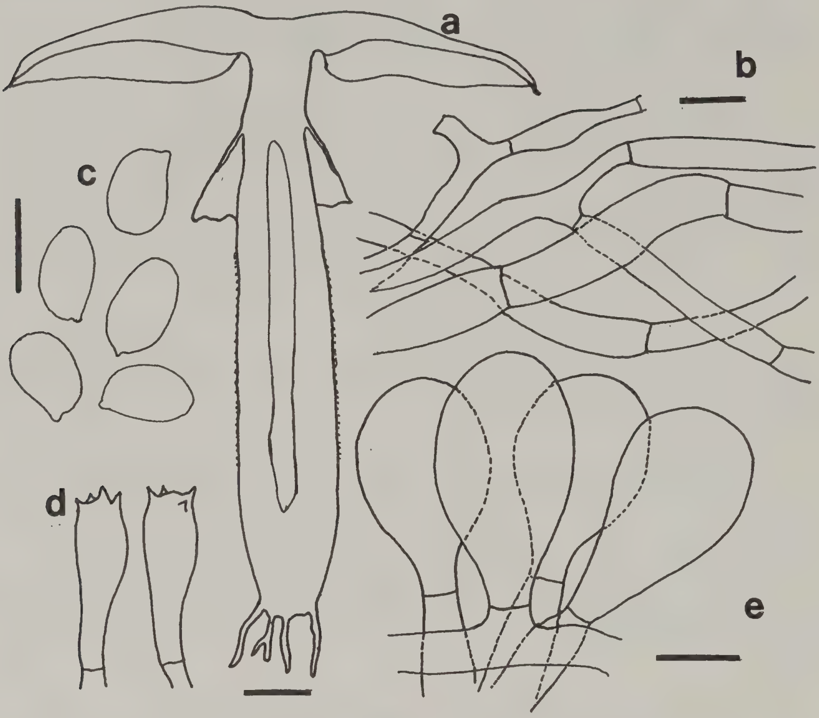

Fig. 2: *A. santacatalinensis*; a) Long. section through fruitbody (Scale bar 1 cm), b) Pilear covering hyphae (Scale bar 10 µm), c) Spores (Scale bar 5 µm), d) Basidia and e) Cheilocystidia (Scale bar 10 µm).

Specimens of collections BAFC 33.414 and 33.413 also showed 2-spored basidia; these spores can be easily recognized because of the larger size: 7-9 x 4-6 µm. This characteristic was not included in the diagnosis since we believe it may be an anomalous feature and was absent in the rest of studied specimens.

A. santacatalinensis is close to *A.rufoaurantiacus* Heinem. found in Trinidad (Heinemann, 1961) and Martinique (Pegler, 1983). Heinemann, in his original description, states that the lamellae remain yellowish for a long time, and finally turn dark brown, but does not mention a differential ripening. In any case, *A.rufoaurantiacus* has smaller spores (4-5 x 2.9-3.6 µm).

A. santacatalinensis is also close to *A.ficophilus*. Microscopically they are very similar, but differ because the latter has smaller clavate cheilocystidia (20-30 x 10-12 µm) and slightly longer spores, 5-6(-6.5) x 3.2-4.3 µm. Macroscopically the diferences are more notorious, as can be seen in a coloured iconography that Heineman published (Heinemann, 1961: p. 249). *A.ficophilus* has a pileus with a yellow brown, large central umbo with dark squamules, and towards the margin, a scaly surface with darker concentrically arranged squamules.

At present four species of subgenus *Lanagaricus* have been recorded for Argentina: *A.lignophilus* Raithelh. (Raithelhuber, 1974), *A.ficophilus* Heinem., *A.oligocystis* Heinem. and *A.spegazzinianus* Heinem. (Heinemann, 1990). We propose the following key for all the known Argentine species of the subgenus:

Key to Argentinian species of *Agaricus* Subgenus *Lanagaricus*

1 . Pileus violet to dark purplish; stem covered with violet squamules under the ring. Cheilocystidia absent .... **A.lignophilus.**
1'. Pileus, orange ochraceous, yellow brown to brown. Cheilocystidia absent or present 2

2 . Cheilocystidia absent .... **A.oligocystis.**
2'. Cheilocystidia present 3

3 . Spores subglobose (Q< 1.20) .... **A.spegazzinianus.**
3'. Spores ellipsoid (Q: 1.30-1.50) 4

4 . Pileus with a large central yellow brown umbo, with dark squamules and then scaly with darker concentrically arranged squamules; cheilocystidia clavate 20-30 x 10-12 µm .... ***A.ficophilus***.

4'. Pileus with yellow to ochraceous, small and dense concentrically arranged squamules; cheilocystidia pyriform to subglobose 14-35 x 14-22 µm .... ***A.santacatalinensis***.

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I am very grateful to the late Dr. Paul Heinemann (Gembloux, Belgium) who read the original typescript and made important suggestions. I also thank Dr. J. E. Wright (Buenos Aires) for his comments and for the Latin transcription. Dr. Roy Halling (NYBG), provided a presubmission review for which I am most grateful.

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MYCOTAXON

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NOTES ON THE ALPINE CORDYCEPS OF CHINA AND NEARBY NATIONS

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Japan)

ABSTRACT

This paper gives an account of 33 species of the genus *Cordyceps* collected from the alpine areas of China and Nepal of these, *Cordyceps kangdingensis, C. multiaxialis and C. nepalensis* are described and illustrated as new species, while *C. sinensis, C. crassispora, C. aspera, C. canadensis* etc. are also reported from China and a few taxa from nearby nations. A key to 33 alpine species of *Cordyceps* from these areas is given.

Kew words Alpine *Cordyceps, C. kangdingensis, C. multiaxialis, C. nepalensis.*

Traditional Chinese medicinal alpine caterpillar fungi are appear to be endemic to the alpine regions of Southwestern and Northwestern China, etc. Some of them are famous in Chinese medicine as a tonic and beneficial to gonadal activity (Liu, 1980; Pegler et al., 1994). The alpine *Cordyceps* are generally regarded as rare species, such as *Cordyceps sinensis* (Berk.) Sacc., (Tai, 1979, Teng, 1996), *C. aspera* Pat. (Patouillard, 1893, Tai, 1979), and *C. crassispora* Zang, Yang et Li (Zang et als., 1990). Recently, the authors made numerous mycological explorations to Deqin region of Yunnan, Kongding region of Sichuan, and some specimens were collected from Guizhou, Tibet and Nepal. Among them there are 3 taxa with morphological features which do not correspond with any of the hitherto described taxa. After detailed study, the authors now describe them as new, *Cordyceps nepalensis, C. kangdingensis* and *C. multiaxialis.*

TAXONOMY

Cordyceps (Fr.) Link, Handbuch 3: 347. 1833.

Syn. *Sphaeria* trib. *Cordyceps* Fries, Syst. Myc. **2:** 325. 1832.

The alpine species of the genus *Cordyceps* from China, especially in southwestern China, including the Himalayas, are treated here according to host biomes and vertical distribution.

Stromata single or rarely branched above, or several in a cluster, caespitose, arising from underground. Fresh fruitbodies composed of fertile part and stalk, carnose or rather coriaceous, stuffed, externally brown–purpurasceous, reddish brown, brown–olivaceous, brown–black, internal part whitish or whitish yellow. Fertile part terminal, cylindric clavate or capitate, sometimes sub–compressed, surface mammillate, punctate with the ostioles of totally embedded or subembedded perithecia, sometimes with separated raphe, longitudinal, thread–like, or nearly smooth. Cortex composed of prosenchymatous or pseudoparenchymatous tissue, usually consisting of one layer of closely interwoven hyphae in section, whitish, whitish yellow or yellow brown, covered with a deep brown palisade–like layer. Perithecia mostly ovoid, free to embedded in the stroma. Asci cylindric, narrowing below, with hemispherical thickening of the wall at the apex. Ascospores hyaline, filiform, multiseptate, breaking into 1– or more–celled, cylindric, linear or subfusoid segments. Secondary spores present or not seen (Mains, 1958; Kobayasi et al. 1960)

Type species: *Cordyceps militaris* (Fr.) Link.

KEY TO THE KNOWN ALPINE SPECIES OF CORDYCEPS

1. Growing on fruit bodies of the genus *Elaphomyces* (Fungi) 2
1. Growing on insects 5
   2. Stromata simple, rarely forked, head globoid, ellipsoid to clavate 3
   2. Stromata cespitose, much branched, head lanceolate, not much differentiated from the stipe .... **26. *Cordyceps racemosa***
3. Head ellipsoid to clavate, dark brown to black. Stipe smooth, with longitudinal striae, attached to the host usually by whitish-yellow branching root-like fibers. Secondary spores 3–4 x 2–3 μm .... **23. *C. ophioglossoides***
3. Head globoid to ellipsoid, yellow-brown to vinaceous fawn. Stipe with a thin layer of loosely interwoven brown hyphae covering the upper part, smooth at the base..............................4
   4. Head small, 5–10 mm diam. yellow to yellow-brown to vinaceous fawn, perithecia ovate, 620–750 x 380–420 μm. Asci 350–400 x 12–15 μm, secondary ascospores cylindrical, 30–45 x 3–3.5 μm.. **4. *C. canadensis***
   4. Head larger, 2.5–7 cm diam., orange-yellow to yellow-brown, perithecia ovate to flask-...... shaped, 900–1100 x 340–430 μm. Asci 500–550 x 12–15 μm, secondary ascospores spindle-shaped, 18–27 x 2.5–3 μm .... **5. *C. capitata***
5. Growing on the larvae of Lepidoptera, distributed over 4000 m alt. (only *Cordyceps gansuensis* distributed between 3700 and 4000 m)..6
5. Growing on the bodies of Lepidoptera or other insects, distributed below 4000 m alt........... 13
   6. Head surface almost smooth, ostioles obscure on the upper portions of stromata, but with obtuse and obscure projections at maturity 11
   6. Head surface rough, ostioles with mammillary projections on the upper portions of stromata 7
7. Stromata narrow clavate, rough or punctate with the ostioles of the perithecia. Stipe usually forming tomentose tufts..8
7. Stromata broad clavate, asperate with the ostioles of the perithecia. Stipe glabrous, on *Emmetrus* .... **9. *C. falcata***
   8. Stipe forming tomentose tufts at the base..9
   8. Stipe glabrous and striate 10
9. Stromata small and gracile, 2–4 cm long, stipe whitish, tomentose at the base, asci short cylindric, 150–200 x 4–5 μm, secondary ascospores 3–5 x 1–1.5 μm, on Coleoptera. .... **1. *C. aspera***
9. Stromata larger, 4.5–6.5 cm long, stipe brown tomentose at the base, asci long cylindric, 170–220 x 7.8–10.4 μm, secondary ascospores 6.5–9.8 x 5.2–6.5 μm, on *Hepialus baimaensis*.. **7. *C. crassispora***

10. Stromata usually clustered, occasionally 2, 3, or 4 from host, asci with 8–10 μm thickening of the wall at the apex and a long narrow base, secondary ascospores 7.8–20 x 0.6–1.2 μm, on larvae of Lepidoptera .... **19. *C. multiaxialis***

10. Stromata simple, asci cylindric with 5–7 μm thickening of the wall at the apex and gradually narrowed at the base, secondary ascospores 14–33 x 2–2.6 μm, on larvae of *Thitarodes* .... **15. *C. kangdingensis***

11. Perithecia ovoid, 320–350 x 270–300 μm, secondary ascospores oblong, 7.7–14 x 8.4–13.3 μm, on *Hepialus luteus,* found only in NW China .... **10. *C. gansuensis***

11. Perithecia globoid or vase shaped, only found in Hengduan Mts. and Himalayas 12

12. Perithecia 150–550 x 110–240 μm, ascospores linear, filamentous, obscurely multiseptate, 120–190 x 0.6–1.3 μm, secondary ascospores not common, on larvae of *Hepialus armorianus* .... **29. *C. sinensis***

12. Perithecia 110–260 x 100–250 μm, ascospores filamentous, clearly multiseptate, 20–70 x 0.5–1.3 μm, breaking into 1–celled secondary ascospores 15–35 x 0.5–1.3 μm, on larvae of *Hepialus nebulosus* .... **21. *C. nepalensis***

13. Stromata always simple, unbranched 28

13. Stromata usually cespitose or branched 14

14. Stomata capitate or obovoid, light vinaceous drab when fresh, stipe slender, usually with rhizoidal branches, perithecia conoid, 600–950 x 230–400 μm, asci cylindric, 300–600 x 4–6 μm, with a 2.5–3 μm thick cap, ascospores multiseptate, secondary spores 6–10 x 1–1.5 μm, on larvae of Coleoptera .... **8. *C. entomorrhiza***

14. Stromata slender, cylindric or clavate, not light vinaceous drab when fresh, stipe cylindric, tufted or branched 15

15. Stromata several from various parts of the host 16

15. Stromata gregarious from the head of the host 17

16. Stromata very variable, short cylindric or clavate, yellowish with whitish mycelia covering adult moths. Perithecia sometimes developing from mycelium covering the adults and pupae of Lepidoptera .... **33. *C. tuberculata***

16. Stromata long cylindric, isabella color when fresh, perithecia not developing from the mycelium, on adult of Cicadidae .... **6. *C. cicadicola***

17. Stromata large, usually 20–30 cm long, 1.5–2.3 mm thick, blackish–brown, stipe solid, on larvae of Lepidoptera .... **16. *C. liangshanensis***

17. Stromata small, usually less than 6 cm long, not blackish brown, stipe soft 18

18. Stromata in 3–5 bundles growing from host head, purplish brown, 7–7.5 cm long, asci cylindric, 305-480 x 3.3–4.5 μm, secondary ascospores clavate, 17–34 x 1–1.4 μm, on larvae of *Pieris rapae* .... **31. *C. taii***

18. Stromata usually separated, with branches from stipe; not in bundles 19

19. Stromata pale brown to chestnut color, asci somewhat fusoid, 150–180 x 5–8 μm, ascospores 85–100 x 1.9–2.2 μm, multiseptate, not breaking into fragments, on larvae of Coleoptera .... **25. *C. petchii***

19. Stromata with intense colors, asci cylindric, filiform, multiseptate, finally breaking into 1–celled fragments 20

20. Stromata clavate or cylindric 27

20. Stromata capitate 21

21. Stromata capitate, light cream to yellow, perithecia conoid, 900–1200 x 210–300 μm, asci cylindric 450–660 x 5–7 μm, with a 6 μm thick cap; secondary ascospores 8–12 x 1.5–2 μm, on wasps, Hymenoptera, Vespidae, etc .... **30. *C. sphecocephala***

21. Stromata bright colored when fresh, except for *C. gracilis* 22

22. Stromata with deep shades of color when fresh, usually dark brown, head globose, perithecia 750–800 x 200–230 μm, flask shaped, asci cylindric, 200–250 x 10–12 μm, secondary ascospores 8–10 x 3–4 μm and rounded at the top, on *Hepialus altaicola* and other larvae of Lepidoptera .... **11. *C. gracilis***

22. Stromata with yellow, reddish or orange colors 23

23. Stromata yellowish in color 24

23. Stromata reddish to orange in color 26

24. Head yellowish.......................................25

24. Head pale yellow in youth, pinkish yellow when mature, perithecia flask shaped, 300–400 x 90–140 µm, secondary ascospores 3.5–4 x 1–1.5 µm, on larvae of *Pleonomus canaliculatus* and *Melanotus candex*.......................**28. *C. shanxiensis***

25. Head 1–1.5 mm diam., yellowish, perithecia ovoid, 450–550 x 300–350 µm, secondary ascospores 7–8 x 1.5–1.7 µm, on Formicidae.......................**20. *C. myrmecophila***

25. Head 3–7 x 1–1.5 mm, pale yellow, perithecia flask shaped, 700–800 x 200–250 µm, secondary ascospores 7–9 x 1.2–1.5 µm, on adults of Homoptera (Cercopidae and Jassidae).......................**32. *C. tricentri***

26. Head roundish, reddish orange or orange brown, perithecia flask shaped or narrowly oblong.......................27

26. Head clavate, orange buff to Mikado orange, perithecia ovoid, 500–720 x 300–480 µm, asci narrowly cylindric, 300–510 x 3.5–5 µm, with a thick cap, 3.5–5 µm, secondary ascospores 2–4.5 x 1–1.5 µm, on pupae and larvae of Lepidoptera........**18. *C. militaris***

27. Head roundish, reddish orange, perithecia narrowly oblong, 500–630 x 150–200 µm, asci capitate, 500–520 µm x 6–8 µm, ascospores filiform, 1–1.5 µm thick, multiseptate, secondary ascospores not seen, on adults of Pentatomidae, Coreidae, etc.......................**22. *C. nutans***

27. Head roundish and oblong, reddish brown or orange brown, perithecia flask shaped, 500–550 x 175–200 µm, the ostiole with very fine mammillation of the fertile part, asci cylindric 230–300 x 7–9 µm, secondary ascospores 4–7 x 1.5–1.7 µm, on larvae of *Oxycanus* and *Trictens*, Lepidoptera.......................**14. *C. hawkesii***

28. Perithecia superficial and free.......................29

28. Perithecia partly or completely embedded.......................30

29. Head golden or reddish yellow, perithecia ovate, 290–320 x 158–180 µm, ascospores cylindric, 140–145 x 6–7.5 µm, multiseptate, breaking into 1-celled fragments 10–11 x 1.5–1.7 µm, on Coleoptera.......................**27. *C. rubiginosoperitheciata***

29. Head golden or reddish, perithecia globose to oblong, 250–330 x 150–230 µm, ascospores cylindric, 100–110 x 2–2.1 µm, multiseptate, tardily breaking into 1- or 2-celled fragments, on Lepidoptera.......................**2. *C. aurantia***

30. Stromata with deep shades of color, blackish brown to blackish, perithecia completely embedded, oblong, 300–350 x 135–150 µm, asci cylindric 100–120 x 6–8 µm, secondary ascospores 4–5 x 1.5–1.7 µm, on larvae of Coleoptera.......................**3. *C. barnesii***

30. Stromata with bright colors, yellow to reddish.......................31

31. Stromata large, stout or slender, usually more than 5 cm long.......................32

31. Stromata small, slender, usually less than 5 cm long.......................33

32. Stromata 10–20 cm long, 5–7 mm thick, clavate, perithecia flask shaped, 830–1100 x 300–400 µm, asci 200–250 x 7–10 µm, secondary ascospores 5–7 x 3–3.2 µm, on Lepidoptera, etc.......................**13. *C. gunnii***

32. Stromata 5.5–12 cm long, 1 mm thick, cylindric, yellow to orange, perithecia conoid, 950–1000 x 190–220 µm, asci long cylindric, 520–550 x 6.3–7 µm, secondary ascospores 14–16 x 1.5–1.7 µm, on adult Vespidae.......................**24. *C. oxycephala***

33. Stromata 2–5 cm long, yellow to ochraceous, perithecia flask shaped, 650–810 x 270–370 µm asci cylindric, 300–310 x 3–4 µm, secondary ascospores 3.5–5 x 1–1.2 µm, on adult Gryllidae.......................**12. *C. grylli***

33. Stromata 5–7 cm long, 2–5 mm thick, clavate, reddish orange, perithecia long flask shaped, 650–750 x 280–300 µm, asci 320–350 x 3–4 µm, secondary ascospores 5–7 x 1–1.2 µm, on Coleoptera and Lepidoptera.......................**17. *C. martialis***

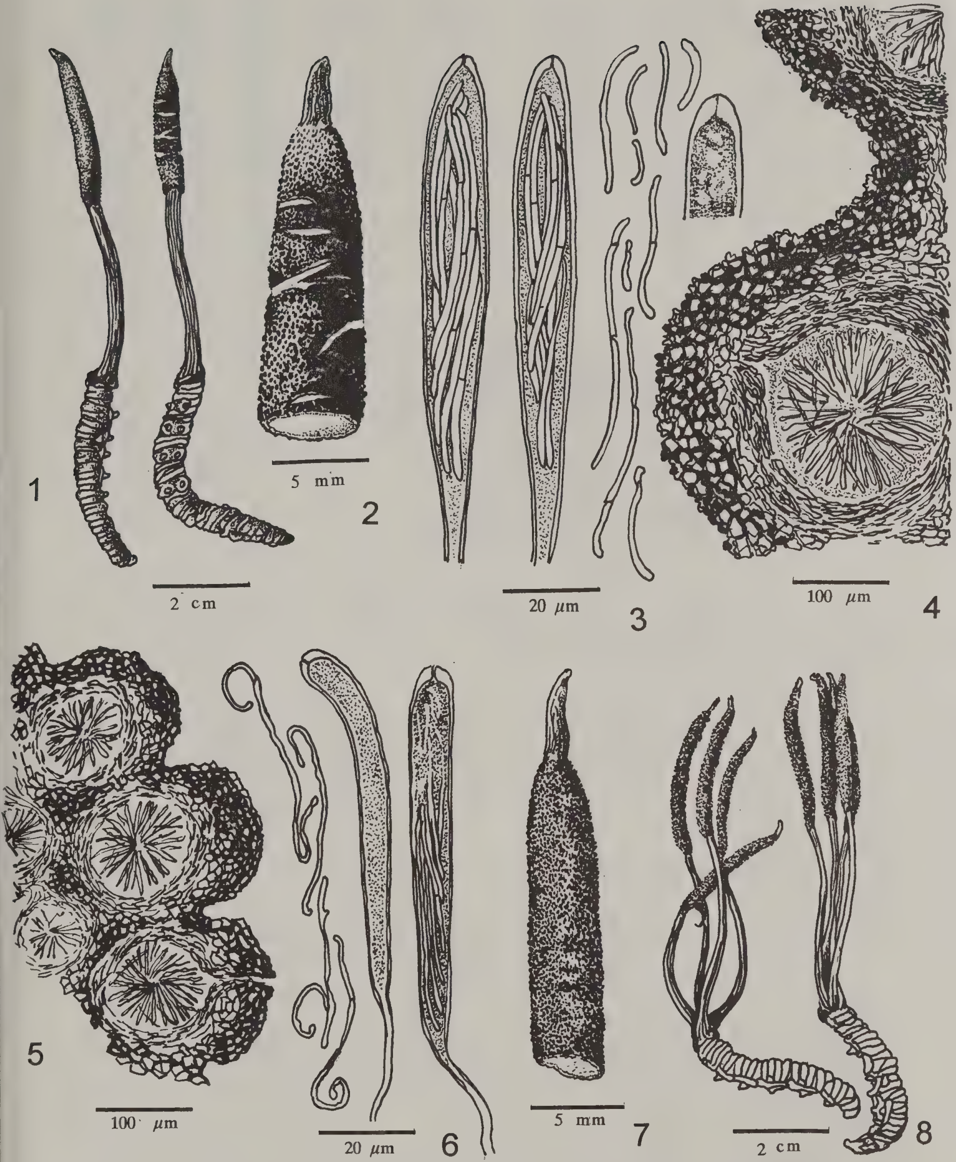
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Fig. I., 1–4, ***Cordyceps kangdingensis*** **Zang et N. Kinjo** 1. Ascocarps. 2. Fertile part of the stroma. 3. Asci and ascospores. 4. Part of a section through the stroma. (HKAS 30255, Typus!) **5-8,** ***Cordyceps multiaxialis*** **Zang et N. Kinjo** 5. Part of a section through the stroma. 6. Asci and ascospores. 7. Fertile part of the stroma. 8. Ascocarps. (HKAS 30258, Typus!)

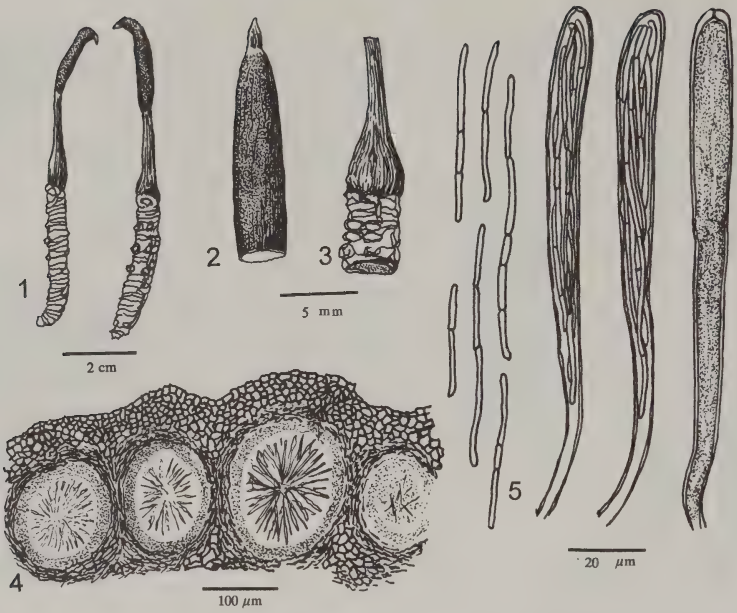


Fig. II., 1-5, ***Cordyceps nepalensis*** **Zang et N. Kinjo** 1. Ascocarps. 2. Fertile part of the stroma. 3. Stipe base on the host. 4. Part of a section through the stroma. 5. Asci and ascospores. (HKAS 28095, Typus!)

1. Cordyceps aspera Patouillard, Journ. Bot. (Morot) **7:** 344. 1893.

Specimens examined. Sichuan: the original lebel is Tibet. 1893. R. P. Farges 6633. Typus in F ! Songpan, Hwanglong Mts. 4300m. 15 V. 1989. Zang & Xia.11572 (HKAS 21981; Songpan, Dunala, 4100 m. 5 VII 1981. Zang 11613 (HKAS 21982)

2. Cordyceps aurantia Y. Kobayasi et D. Shimizu, Bull. Natn. Sci. Mus. **6**(4): 125. 1980.

Specimen examined. Yunnan, Jingdong, Eilo Mts. under evergreen forest, on rotten wood, 2330 m. 23 VIII 1994. Zang 12362 (HKAS 29635)

3. Cordyceps barnesii Thwaites ex Berk. et Br., Journ. Bot. Linn. Soc. **14:** 110.1875.

Specimens examined. Hainan Island, Yen County, on larvae of Lamellicornia, Coleoptera, 16 VII 1934. S. T. Deng 3272, typus ! in Herbarium, U. S. National Fungus Collections (BPI); Guangdong, Dinghu Mts. 21 IV 1981. Bi 323 (HMIG4323)

4. Cordyceps canadensis Ellis et Everh. Bull. Torrey Bot. Club **25:** 501. 1898.

Specimen examined. Jilin, Changbai Mts. Natural Reserv., on *Elaphomyces granulatus* Fr. 4 VIII 1985. X. L. Zeng 748. (Herbarium, Northeast Teacher's University, Jilin). (Zeng & Yang, 1990)

5. Cordyceps capitata (Holmskj.) Link, Handbuch Erkenn. Gewaechse **3:** 347. 1833.

Clavaria capitata Holmskj., Fung. Dan. 1: 38. 1790.

Specimen examined. Yunnan, Kunming, Western Mts. 16 VIII 1938. J. Z. Chou. (no number)

6. Cordyceps cicadicola Teng, Siniensia **6:** 191. 1935.

Specimen examined. Hainan Island, Tan County, on adult of Cicadidae. 8 XI 1939. S. C. Teng 6179, 4141 (Typus ! BPI)

7. Cordyceps crassispora Zang, Yang et Li, Mycotaxon **37:** 58. 1990. (Fig. III: 1)

Specimen examined. Yunnan, Deqin, Bai Ma Snow Mts. 4300 m. 18 V 1996. Zang 12747. (HKAS 30203)

8. Cordyceps entomorrhiza Link, Handbuch **3:** 347. 1833.

Specimen examined. Yunnan, Jingdong, Xiu Jia Ba, 2500 m. on larvae of *Diabrotica*. 25 VIII 1994. Zang 12418 (HKAS 29638)

9. Cordyceps falcata Berk. in Hooker, Journ. Bot. **6:** 211. 1854.

Specimen examined. Tibet, lower Yalongzangbu (River), on larva of Coleoptera. (Wang & Zang, 1983)

10. Cordyceps gansuensis K. Zhang, C. Wang et M. Yan, Trans. Myc. Soc. Japan **30:** 295. 1989.

Specimens examined. Gansu, Maqu County, Dashui, 3600–3800 m. C. Wang 11888; Jishi Shan, 4000 m. Wang 11816. (Shimizu, 1994)

11. Cordyceps gracilis Durieu et Montagne, Flore Algerie Cryptoga. **1:** 449. 1849.

Specimens examined: Xinjiang, on *Hepialus altaicola* Chiu, *Hepialus luteus* Groum–Grshimailo, V – VI. 1990. H. Zhou (Microbio. Inst. Xinjiang Agri. Sci.Acad. no. number); Yunnan, Lijiang, Yulong Mts. 3000 m. under *Abies forest*. 1 VIII 1985. Zang 10196 (HKAS 15098); Jingdong, Ailou Mts. 2500 m. 25 VIII194. Zang 12417 (HKAS 29637)

12. Cordyceps grylii Teng, Sinensia **7:** 811. 1936.

Specimen examined. Hainan Island, Yen County, 13 VI 1934. S. C. Teng 3243 Typus ! in BPI)

13. Cordyceps gunnii (Berk.) Berk., in Hooker F., Flora Tasman. **2:** 278. 1859.

Sphaeria gunnii Berk., in Lond. Journ. Bot. **7:** 577. 1848.

Specimens examined. Jiangxi, Wuyi Mts. 1200 m. 29 III 1985. Y. C. Jiang 3 (HKAS 20258); Huizhou, Molan, Mougan, 1000 m. 2 V 1984. X. L. Wu 1673.

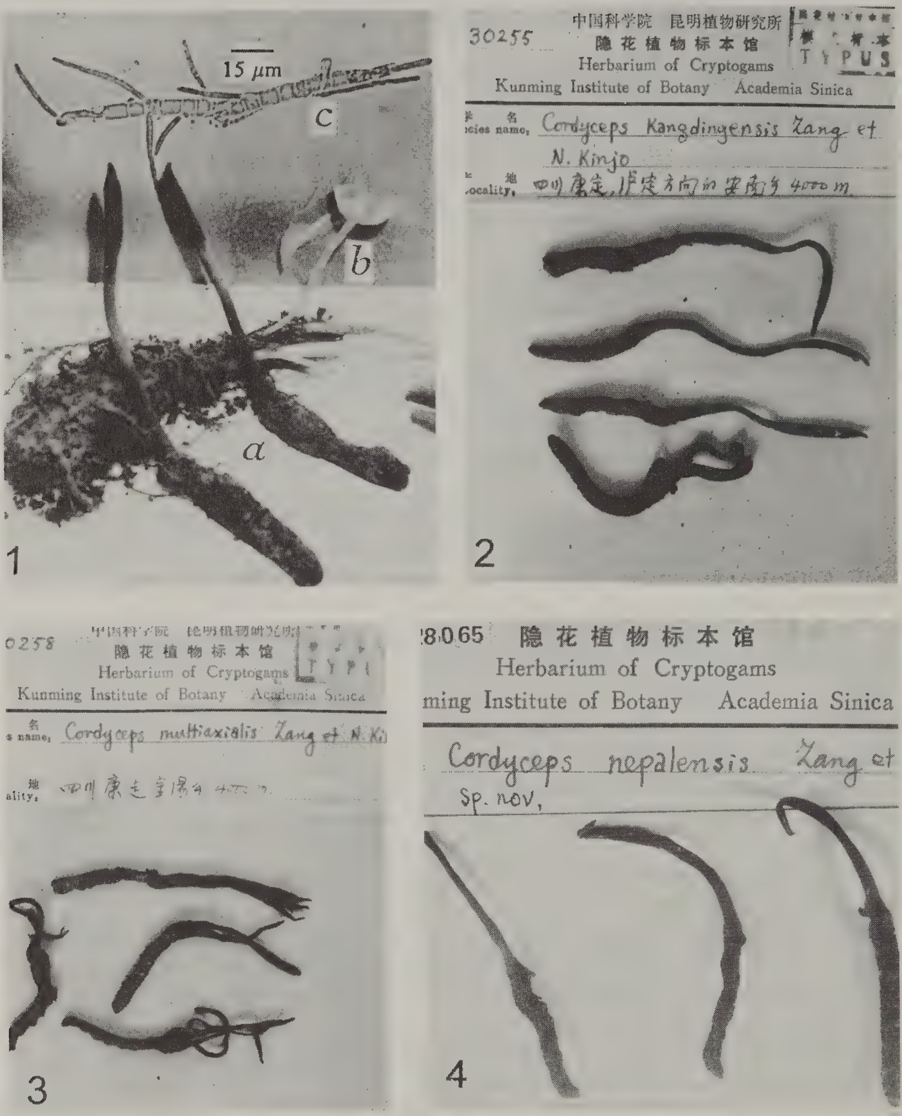
14. Cordyceps hawkesii (Gray) Cooke, Grevillea **19:** 76. 1891.

Sphaeria hawkesii Gray, Notices Insects Fungi **2:** 10. 1858.

Specimens examined. Hunan, Anhwa County, Zijiang, on larvae of *Oxycanus, Trictens,* 6 VI 1989. F. L. Xong 1 (HKAS 21945); Jiangxi, Xing Guo County, on larvae of *Trictens*, 5 V 1987. Y. C. Jiang 1 (HKAS 20257); Guangdong, Dinghuo Mts. 30 III 1981. Bi (no number)

15. Cordyceps kangdingensis Zang et N. Kinjo, sp. nov. (Fig. I: 1–4; III: 2)

Stromatibus clavatis, singularibus, 6.2 – 7.5 cm longis, 2 – 4 mm crassis, capitulis cylindricis, 3.2 – 3.5 cm longis, 3 – 4 mm crassis, porphyro–brunneis, atro–violaceis; apis acerosis sterilibus; cortice pseudoparenchymato; peritheciis



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Herbarium of Cryptogams
Kunming Institute of Botany Academia Sinica
TYPUS
cies name, Cordyceps Kangdingensis Zang et N. Kinjo
ocality, 四川康定，炉定方向的安康乡 4000 m

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ality, 四川康定雪阳乡 4000 m

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Cordyceps nepalensis Zang et
Sp. nov,

Fig. III. 1: a. Ascocarps of *Cordyceps crassispora*, b. *Polygonum macrophyllum* D. Don, c. secondary ascospores of *Cordyceps crassispora* multiply by budding, Bar = 15 μm. 2. Ascocarps of *Cordyceps kangdingensis* (HKAS 30255, Typus). 3. Ascocarps of *Cordyceps multiaxialis* (HKAS 30258, Typus). 4. Ascocarps of *Cordyceps nepalensis* (HKAS 28065).

globoideis vel ovoidis; ostiola displicata, 3 per mm., superficialibus, exasperatus. Stipitibus 3 – 4.5 cm longis, 3 – 4 mm latis, aequalis, levigatis. Ascis cylindraceis, 55 – 80 × 6.5 – 12 μm, 8–sporis. Ascosporis hyalinis vel luteolis, filiformis, multiseptatis, 14 – 33 × 2 – 2.6 μm.

In larvis *Thitarodetis*. (Ueda, 1996)

Sichuan: Kangding, Annan Xiang, 4000 m. 4 Vi 1996. Zang 12742 (HKAS 30255,Typus !) ; Kangding, Huang Co Ping, 4200 m. 6 VI 1996. Zang 12743. (HKAS 30256)

Stromata clavate, simple, 6.2 – 7.5 cm long, 2 – 4 mm diam., ascogenous portion two–fifths to one half the length, abruptly enlarged from the stipe, 3 – 4.5 cm long, 3 – 4 mm thick, purplish brown to dark violet, each with a sterile acuminate apex 2 – 3 mm long, rough or punctate with the ostioles of the perithecia, with a cortex consisting of one layer of closely interwoven hyphae, pseudoparenchymatous in section. Perithecia globoid or ovoid, 200 – 350 × 180 – 400 μm, almost entirely embedded in the stroma, but the ostioles projecting above the roughened surface, each ostiole arranged separately, 3 ostiolae per mm., deep brown when dry. Asci cylindric, a gradual narrowing below, 52 – 78 × 9 – 12 μm with a hemispherical thickening of the wall at the apex. Ascospores hyaline, filamentous, multiseptate, 14 – 33 × 1.3 – 2.6 μm, breaking into 1–celled segments 14 – 20 × 1.3 – 2.6 μm. Stipe 3 – 4.5 cm long, 3 – 4 mm thick, glabrous and striate when mature.

Host. Larvae of aff. *Thitarodes* sp. (Lepidoptera, Hepialidae)

This species differs from *Cordyceps sinensis* (Berk.) Sacc., in having much shorter asci (55 – 80 × 6.5 – 12 μm) and shorter, thinner ascospores (14 –33 × 1.3 – 2.6 μm). The asci of *Cordyceps sinensis* are always longer [220 – 240 (400) × 5.2 – 6.5 (13) μm] (Zang & Kinjo, 1996). The species can be separated easily, however, by the epicutis of rough perithecia.

16. Cordyceps liangshanensis Zang, Liu et Hu, Acta Botanica Yunnanica 4(2): 174.1982.

Specimens examined: Sichuan, Liangshan, Yuexi, 20 VII 1992. X. X. Chen 1.
(HKAS 25468); Guizhou, Sui Yang County, Kuan Ke Shui, 1 VI 1984. Zhou 1.
(HKAS 20296); Yunnan, Zhaotong, Da Guan, 2600 m. 10 IX 1991. S. G. Wu 1.
(HKAS 23624); Yongshan Co. 1500 m. 20 IX 1985. Yang 1 (HKAS 17356)

17. Cordyceps martialis Spegazzini, Fungi Puiggarini, no. 305. in Bol. Acad. Nac. Cordova 11. 1889.

Specimens examined. Guangdong, Dinghu Mts. 16 IV 1985. Bi et al. 8552 (HMIGD); Yunnan, Mengla County, Mengbang,700 m. 13 VIII 1994. S. Uchiyama 3. (HKAS 28256)

18. Cordyceps militaris (L. : Fr.) Link, Handb. Erkenn. Nutzb. Gew. 3: 347.1833.

Clavaria militaris L., Sp. Plant. 2: 1182. 1753.

Specimens examined. Hebei, Qingyun. 14 VII 1991. J. C. Li 1. (HKAS 23821); Shandong, Mengyin County, Meng Shan, 1400 m. Y. K. Lei 1; Anhui, Huang Shan, 1934. S. C. Teng (no number); Guizhou, Jiang Ko County, Fanjing Mts. 1900m. 19

VI 1988. R. F. Lu 3 (HKAS 20660); Yunnan, Kunming, Western Mts. 2000 m. 20 IX 1988. D. C. Chang 1 (HKAS 20313); Dulong Jiang area, 3600 m. on larvae of Lepidoptera, 26 VII 1980. Zang 257. (HKAS 10696); Tibet, Motou. 10 XI 1982. Y. G. Su 1336. (HKAS 16055)

19. Cordyceps multiaxialis Zang et N. Kinjo, sp. nov. (Fig. I: 5 – 8; III: 3)

Stromatibus clavatis, multiaxialis, 4 – 5.2 cm longis, 1.5 – 3 mm crassis, capitulis cylindricis, gracilibus, 1.3 – 2 cm longis, 1 – 2 mm crassis. porphyro–brunneis vel atro–brunneis, apis acerosis sterilibus; cortice pseudo–parenchymato; peritheciis globoideis, 100 – 300 × 100 – 320 μm. Ostiola densa, 4 ostiola / 1 mm., superficialibus excelsis. Stipitibus 2 – 2.5 cm longis, 1.2 – 2.2 mm crassis, aequalis, levigatis. Asci clavuli, cylindraci, ad basin sensim angustati, 25 – 52 (104) × 7.8 –9.1 μm, 8–sporis. Ascosporis hyalinis, filiformis, multiseptatis, 7.8 – 20 × 0.6 – 1.2 μm.

In larvis aff. *Thitarodetis.*

Sichuan: Kangding, Jin Tang Xiang 4000 m. 4 VI 1996. Zang 12745 (HKAS 30258, Typus !); Litang, Da Xie Mts. 4100 m. 25 V 1996. Zang 12744 (HKAS 30257)

Stromata clavate, in clusters, occasionally 2, 3 or 4 from host, 4 – 5.2 cm long, 1.5 – 3 mm diam., ascogenous portion two–fifths to less than half the length, abruptly enlarged from the stipe, long cylindric, slender, 1.3 – 2 cm long, 1–2 mm thick, purplish brown to dark brown, each with a sterile acuminate apex 2 – 2.5 mm long, punctate with the ostioles of the perithecia, with a cortex consisting of single layer of closely interwoven hyphae appearing pseudoparenchy matous in section; perithecia globoid, 100 – 300 × 100 – 320 μm. many and very closely crowded in irregular lateral cushions, but the ostiola projecting above the smooth surface, each ostiole arranged densely, 4–4.5 ostiola per 1 mm., blackened when mature. Asci clavate, with 8 – 10 μm thickening of the wall at the apex, narrow at the base, 25 – 52 (104) × 7.8 – 9.1 μm. Ascospores hyaline, filiform, multiseptate, 7.8 – 20 × 0.6 – 1.2 μm. Stipe 2 – 2.5 cm long, 1.2 –2.2 mm thick, glabrous and with longitudinal parallel striae when dry.

Host: Larvae of aff. *Thitarodes* sp. (Lepidoptera, Hepialidae)

This species has some resemblance to *Cordyceps kangdingensis* Zang et N.Kinjo, especially in color and hosts. It differs in that the epicutis of the perithecia are smooth, without small nipple–like projections, asci clavate with thickening wall at the apex and with a narrow base, and smaller ascospores (7.8 – 20 × 0.6 – 1.2 μm).

20. Cordyceps myrmecophila Cesati, Bot. Zeit. 4: 877. 1846.

Specimens examined. Guangdong, Ding Hu Mts. J. Q. Liang 449; Hainan Island, Ledong County, Jian Feng Ling (Mts.) 800 m. 8 VIII 1989. Zang 11619 (HKAS22173)

21. Cordyceps nepalensis Zang et N. Kinjo, sp. nov. (Fig. II: 1 – 5; III: 4)

Stromatibus clavatis, singularibus, 4.1 – 4.5 cm longis, 2 – 3.5 mm crassis, capitulis cylindricis 2.2 – 2.5 cm longis, 2 –3 mm crassis, porphyro–brunneis vel atro–bruneis, apis acerosis sterilibus; cortice pseudoparenchymato; peritheciis globoides vel ovoidis, 110 – 260 × 100 – 250 μm, ostiola densa, 5–6 / 1 mm. superficialibus, levigatus, sublevigatus, Stipitibus 2 – 3 cm longis, 3 –4 mm latis, aequalis, levigatis, latus factus ad basim. Asci clavuli, cylindraci, ad basin sensim angustati, 102 – 120 × 5 – 9 μm, 8 – sporis. Ascosporis hyalinis, filiformis, multiseptatis, 20 – 70 × 0.5 – 1.3 μm.

In larvis *Hepiali nebulosi* Alpheraky.

Nepal, Himalayas Mt. Kangchenjunga, 4300 m. N. Kinjo 1. 6 VIII 1992. (HKAS 28095, Typus !). Kathmandu (Market place) 28 VII 1997. Y. Tang 1. (HKAS. 30313).

Stromata clavate, simple, 4.1 – 4.5 cm long, 2 – 3.5 mm diam., ascogenous portion almost one half of the length, gradually enlarged from the stipe, 2 – 2.2 cm long, 3 – 5 mm thick, purplish brown to dark brown, each with a sterile acuminate apex 2 – 2.1 mm long, almost smooth with the ostioles of the perithecia. Perithecia globoid or ovoid, 110 – 260 × 100 – 250 μm. embedded in the stroma with a well differentiated brown wall 30 – 80 μm thick, each ostiole arranged densely, 10 – 12 ostiolae / 2 mm., brown when dry. Asci clavate or cylindric, gradually narrowing below, 102–120 × 5 – 9 μm. Ascospores hyaline, filamentous, multiseptate, 20 – 70 × 0.5 – 1.3 μm, breaking into 1 celled segments 15 – 35 × 0.5 – 1.3 μm. Stipe 2 – 3 cm long, 3 – 4 mm thick, broad at the base, glabrous and striae when mature.

Host: Larvae of *Hepialus nebulosus* Alpheraky.

This species has some resemblance to *Cordyceps sinensis* (Berk.) Sacc., especially in color and in dry specimens was misidentified as such, but differs in that the perithecia and ostiola are embedded under the surface, the asci and ascospores all are shortèr and the septation clearer than in *C. sinensis*.

22. Cordyceps nutans Patouillard, Bull. Soc. Myc. France **3:** 127. 1887.

Specimens examined. Guizhou, Fanjing Mts., 1700 m. 10 VI 1987. X. L. Wu 2926 a, (HKAS 18512); Yunnan, Jinghong, Nabang River area 1000 m. on adult of Pentatomidae. 16 VIII 1995. Zang 12598 (HKAS 29532); Yongshan County, Kuixi, 1700 m. 4 IX 1985. L. X. Yang 850013 (HKAS 16965)

23. Cordyceps ophioglossoides (Ehrh.) Fr., Summa Veg. Scand. p. 381. 1849.

Sphaeria ophioglossoides Ehrh. Exs. n. 160. in Fries Syst. Myc. **2:** 324. 1822.

Specimens examined. Yunnan, Zhongdian, WuFeng Mts. 3700 m. 19 IX 1993. Zang 11988 (HKAS 26934); Lijiang. Yulong Mts. Sandaowan 2900 m. 8 IX 1986. Zang 10816 (HKAS 17867)

24. Cordyceps oxycephala Penz. & Sacc. Malpighia **11:** 521. 1897.

Specimens examined. Guangdong, Dinghu Mts. 20 V 1981. J. Q. Liang 433; Hainan Island, Ledong County, Jian Feng Ling (Mts.) 800 m. 8 VIII 1989. Chen & Zang 11618 (HKAS 22172)

25. Cordyceps petchii Mains, Bulletin of the Torrey Bot. Club **86**(1): 47. 1959.

Specimen examined. Sichuan, Rue Er Gai, 3000 m. 24 III 1986. R. Q. Huang 1 (HKAS 18204)

26. Cordyceps racemosa Berk., in Hooker, Journ. Decad. n.480. t. 8. f. 3. 1854; Sacc., Syll. Fung. **2:** 576. 1883.

Specimen examined. Tibet, Motou, on *Elaphomyces*. (Wang & Zang, 1983)

27. Cordyceps rubiginosoperitheciata Y. Kobayasi et D. Shimizu, Bull. Natn. Sci. Mus. **9** (1) : 4. 1983.

Specimens examined. Yunnan, Pingbian, Da Wei Mts. 2100 m. 7 X 1995. Zang 12665 (HKAS 30140); Wenshan County, Malipo, Lao Jun Mts. 1500 m. 1 X 1995. Zang 12605 (HKAS 30178)

28. Cordyceps shanxiensis Liu, Rong et Jin, Journ. Wuhan Botanical Research **3** (1): 23. 1985. Specimen examined. Shanxi, Zhong Tiao Mts., Yu Wang Ping. 1900 m. on larvae of *Pleonomus canaliculatus* Faldermann and *Melanotus candex* Lewis. 17 V 1984. Rong & Jin 84004 (HBSU 2467).

29. Cordyceps sinensis (Berk.) Sacc., Mich. **1:** 320. 1878.

Sphaeria sinensis Berk., Lond. Journ. Bot. **2:** 207. 1843.

Speimens examined. China, Herb Berkley, 1879, (Typus ! in K); Sichuan, Muli, Donglang, 4600 m. 14 V 1983. . S. Wang 1 (HKAS 11796); Sichuan, Herb N. Patouillard 1878 (F); Xiojin County, Congde, 3900 m. 3 VI 1996. Zang 12740 (HKAS 30253); Kongding, Xindu, 3950 m. 4 VI 1996. Zang 12741 (HKAS 30254); Kangding, Tagong, 3900 m. 5 VI 1996. Zang 12746 (HKAS 30252); Gansu, Gannan, Maqugou, 3700 m. V. 1980. Li 4. (HKAS 17019); Xinjiang, Tian Shan, Altai Mts. (Zhao Mao, 1985); Yunnan, Lijiang, Yulong Mts. 4100 m. 2 VI 1981. L. S. Wang 815 (HKAS 7494); Qinghai, Yushu, 4000 m. 14 VI 1976. Huang 12; Tibet, Ridong, Mengong, 14 V 1995, Shi 1 (HKAS 29365).

30. Cordyceps sphecocephala (Klotzsch) Massee, Ann. Bot. **9:** 13. 1895.

Sphaeria sphecocephala Klotzsch, in Berk., Lond. Journ. Bot. **2:** 206. 1843.

Specimen examined. Tibet, Yaluzang Bo (River), on *Polistes, Trachytes* and *Vespa* etc. (Wang & Zang, 1983)

31. Cordyceps taii Liang et Liu, Acta Mycologica Sinica **10**(4): 257, 1991.

Specimen examined. Guizhou, Du Yun, on *Pieris rapae* Linn. and *Metarhizium anisopliae*, 30 VIII 1980. Liang (SGAC 2905)

32. Cordyceps tricentri Yasuda in Lloyd, Myc. Writ. 4. Let. **60:** 14. 1915. Specimens examined. Guangdong, Ding Hu Mts, 27 VI 1981. T. H Li 814 (HMIGD); Yunnan, Dulonjiang area, Qiqi, 2000 m. on adults of Vespidae, 20 VII 1982. D. C. Chang 127 (HKAS 10666)

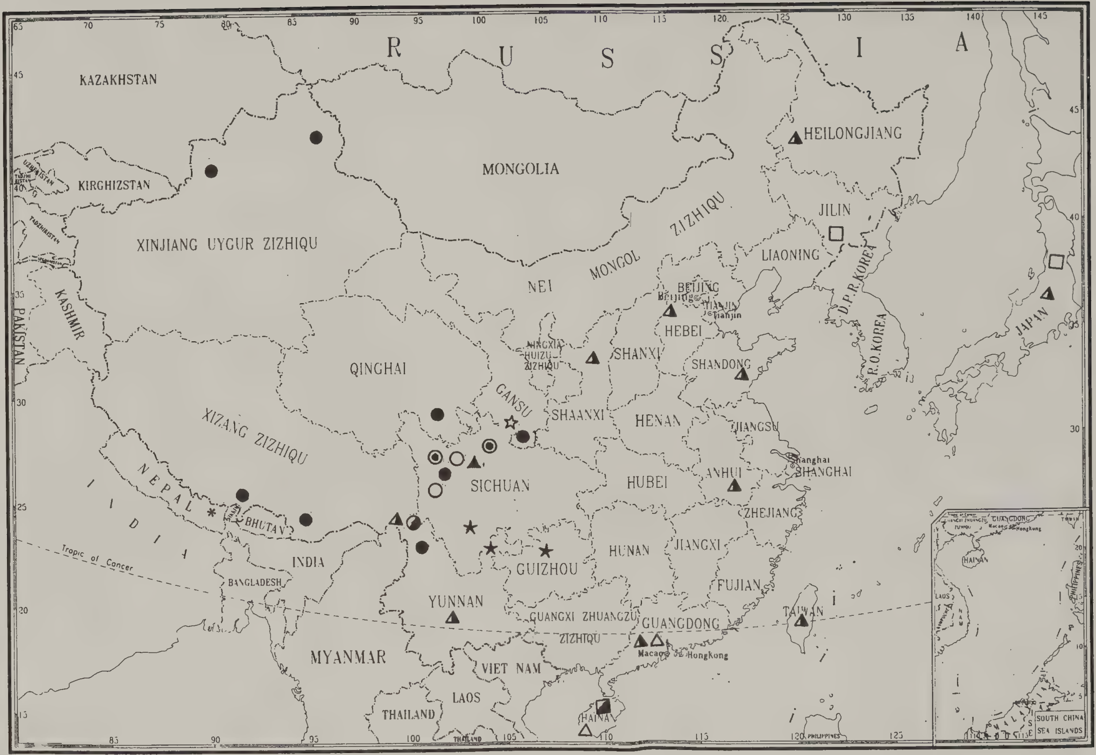
33. Cordyceps tuberculata (Lebert) Maire, Bull. Soc. Hist. Nat. Afrique Nord. **8:** 165. 1917.

Akrophyton tuberculatum Lebert, Zeitschr. Wiss. Zool. **9:** 448. 1858.

Specimen examined. Yunnan, Mengla County, Caiping Mts. 800 m. on adult moths, Lepidoptera, Sphingidae, *Coccytius* etc. 10 VII 1995 m. Zang 12687 (HKAS 29640)

GEOGRAPHIC DISTRIBUTION

The alpine region generally includes the Hengduan Mountains, Eastern Himalayas, and certain alpine areas of China and nearby nations. In these zones all the wet and moist alpine vegetations are to be found. *Polygonum, and Astragalus* are widely distributed, preferring sunny sites, steep slopes and drier areas,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KAZAKHSTAN
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HEILONGJIANG
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XINJIANG UYGUR ZIZHIQU
NEI MONGOL ZIZHIQU
BEIJING
Beijing
TIANJIN
Tianjin
HEBEI
D.P.R.KOREA
R.O.KOREA
JAPAN
KASHMIR
PAKISTAN
QINGHAI
NINGXIA HUIZU ZIZHIQU
SHANXI
SHANDONG
GANSU
SHAANXI
HENAN
JIANGSU
Shanghai
SHANGHAI
XIZANG ZIZHIQU
SICHUAN
HUBEI
ANHUI
ZHEJIANG
NEPAL
BHUTAN
INDIA
HUNAN
JIANGXI
GUIZHOU
FUJIAN
Tropic of Cancer
BANGLADESH
YUNNAN
GUANGXI ZHUANGZU ZIZHIQU
GUANGDONG
TAIWAN
Macao
Hongkong
MYANMAR
VIET NAM
LAOS
THAILAND
HAINAN
PHILIPPINES
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Fig. IV. Geographic distribution pattern of the alpine *Cordyceps* of China and near–by nations

● *Cordyceps sinensis*, □ *C. canadensis*, ▲ *C. kangdingensis*, ○ *C. multiaxialis*, ☆ *C. gansuensis*, ★ *C. liangshanensis*, △ *C. oxycephala*, ◪ *C. cicadicola*, ◑ *C. crassispora*, ▲ *C. militaris*, ✱ *C. nepalensis*, ◉ *C. aspera*

Rhododendron, Fritillaria delavayi Franch, and *Meconopsis ferrestii* Prain occur almost everywhere but more abundantly in the wetter parts of alpine mountains.

The typical inhabitants of higher altitudes above 4000 m are, however, bio–diverse types of insects, especially Lepidoptera, *Thitarodes, Heplialus* etc., which represent a rare type of animal life that can live as high up as 4000 – 4500 m. alt. Most species of the genus *Cordyceps* are parasitic on the larvae of *Lepidoptera* as carvivores or parasites, a mass of mycelium filling the host bodies. Insects such as *Thitarodes armoricanus* (Oberthuer) Ueda, *T. kangdingroides* (Chu et Wang) Ueda, *T. danieli* Viette, *T. eberti* Viette (K. Ueda, 1996), *Hepialus baimaensis* Liang, etc., all are common in Hengduan Mountains and Himalayas. *Cordyceps* ascocarps usually develop and come to maturity in April to June, only a few in July, and arise from buried mummified larvae of Lepidoptera, on infection from secondary ascospores, which multiply by budding (Fig. III: 1, C). Hyphal bodies develop in the haemocoel of the larvae.

Certain members of the genus *Cordyceps*, e. g., *Cordyceps kangdingensis* and *C. multiaxialis* occur in Kangding, Sichuan; *C. crassispora* in Deqin in Yunnan, and *C. nepalensis* in Nepal, and probably also in Tibet. They are all found in the Hengduan Mts and Himalayas (Fig. IV). *Cordyceps sinensis* is known to be widely distributed in Gansu, Qinghai, Sichuan, Yunnan and the Himalayas, all well known for enormous adaptation on such alpine mycotaxa. The alpine *Cordyceps* members often associate with *Polygonum viviparum* L., *P. affine* D. Don, *P. macrophyllum* D. Don (Fig. III: 1, b), *P. glaciale* (Meisn.) Hook. f., *Astragalus balfourianus* Simpson, *A. craibianus* Simpson, etc.

Most of the species are able to spread widely in China when environmental conditions are favorable. For example, *Cordyceps canadensis* is scattered along the Chang Bai Mountains, 1400 – 1800 m., Jilin, and over wide areas in Yamagata, Japan and Canada proper. *C. gansuensis* is found in Maqu County, Gansu, 3600 – 3800 m. (Shimizu, 1994). Each fungus has evolved its own distinctive assemblage of plants and insects. Moreover, the alpine caterpillar fungi generally inhabit different kinds of insect hosts and plants, which have converged in their ecological association with more or less separated outposts in southern regions of China, e. g., *Cordyceps barnesii, C. oxycephala*, and *C. myrmecophila*. They are recorded in Dinghu Mountains, Kongdong (Bi et als.,1994) and Jianfengling (Mts.), Hainan Island, the type locality of *Cordyceps cicadicola* and *C. grylli*, only recorded from Hainan Island. Most of the other species, e. g., *Cordyceps liangshanensis*, distributed only in Sichuan, Guizhou, Yunnan (1500 – 2600 m. alt.) (Fig. IV), *C. gunnii, C. hawkesii* have a wide distribution range in Central and Eastern China.

The *Cordyceps* fungi are not only parasitic on insects, but also on fungi, especially on the subterranean ascocarps of the genus *Elaphomyces*, e. g. *Cordyceps racemosa* in Tibet, *C. ophioglossoides* and *C. capitata* in Yunnan, and *C. canadensis* in Jilin.

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ASPERGILLI FROM THE DIGESTIVE TRACT OF BRAZILIAN TRIATOMIDS

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Abstract

A taxonomic study of 21 *Aspergillus* species isolated from triatomids, insects vectors from Chaga's Disease, was carried out. Four species are new records for Brazil: *A.aureolatus, A.foetidus, A.pulverulentus* and *A.pulvinus*. The macro- and microcharacteristics are presented for these, and for two other species previously reported from Brazil but not described, as well as a review on the habitat and geographical distribution of the already reported species in Brazil.

Introduction

American trypanosomiasis or Chagas'disease is a zoonosis of the American continent, extending from the south of the US to Argentina and with a high incidence in Brazil. The main vectors of the disease are the triatomids (Reduviidae, Triatominae), known by their popular names "barbeiros or "chupões". They are big, varing from 1 to 4 cm in lengh, obligate hematophagous insects during their entire development, and with nocturnal feeding habits (Rey, 1991).

Because it is a disease of great importance in Brazil, with over 6 million infected people, studies on the different biological features of these insects became necessary for the development of biological control methods of these vectors or of the *Trypanosoma cruzi* parasite itself.

Existence of fungi in the digestive tract of triatomids was observed by Cavanagh & Marsden (1969) who found *Aspergillus versicolor* in three *Rhodnius prolixus* specimens. In order to gain more knowledge on this fungal flora, a survey of the mycobiota present in the digestive tract of eight triatomid species is being carried out in our laboratory. Although *Penicillium* was the most frequently isolated genus during this survey, *Aspergillus* which was second in frequency, but had the greatest species diversity.

The *Aspergillus* genus is widely distributed in nature, mainly due to its ability to grow on various substrates, such as decomposing organic material (Raper & Fennell, 1965; Samson & Pitt, 1990), different soil types (Mattede et al., 1986; Dunn et al., 1989; Sarquis & Oliveira, 1996), terrestrial and aquatic insects (Batra et al., 1973; Gilliam et al., 1974; Hay et al., 1993; Costa et al., 1993) in the most varied environmental conditions, being considered one of the genera of major economic importance with large application in biotechnology (Samson & Pitt, 1990). Its entomopathogenic and entomotoxigenic potential is recognized (Laakso & Gloer, 1993; Drummond & Pinnock, 1990; Gilliam et al.,1990).

But there are a few works about the relations between this fungal genus and insect vectors of tropical diseases. Schlein (1985) isolated *A. sclerotiorum* and *Saccharomyces cerevisiae* from *Phlebotomus* species vectors of *Leishmania* and reported that in laboratory experiments *Leishmania major* did not survive in sandflies which had fungus in their gut.

The objective of the present study are the detection and taxonomic study of *Aspergillus* spp. isolated from the digestive tract of triatomids.

Material and methods

Nine hundred four insects belonging to eight triatomid species were investigated: *Triatoma sordida, T.infestans, T.brasiliensis,T.pseudomaculata, Rhodnius prolixus, R.neglectus, Panstrongylus megistus* and *Dipetalogaster maximus*. The insects were obtained from the Laboratório de Triatomíneos, Departamento de Medicina Tropical, Instituto Oswaldo Cruz - Fiocruz. These insects were sterilised by consecutives.washings in 10% sodium hypochloride, sterile distilled water, iodine alcohol and 70% alcohol for 1 min. each, then they were dissected according to Lacombe & Rangel (1977) in Veco® class II vertical laminar flow aseptic chamber and the guts were removed. For each Triatomids species pools were made with the guts of 10 to 20 insects which were macerated in 0.4ml of Phosphate Buffer Saline (PBS).

The macerated samples were processed according to the technique of Lachaise et al. (1979) and seeded on Petri dishes containing the following culture media to which 0.05g per l. of chloramphenicol (Sigma) were added; PDA (Potato Dextrose Agar, Difco); MEYEA [malt extract (Difco), yeast extract (Pro-analysi) and agar (Merck)] and YEPGA [yeast extract, peptone (Difco), glucose (Pro-analysi) and agar]. The plates were incubated at 28^0 C and examined every three days for 21 days. The colonies were counted and transferred to tubes with PDA.

Strains identified as *Aspergillus* spp were transferred to Petri dishes with a 9cm diameter containing CZ (Czapek-dox, Difco) and incubated at approximately 28^0C room temperature. Growth rates of the colonies were measured after 10 days of incubation using a Mitutoyo digimatic caliper with 0.01mm resolution.

The microscopic characteristics presented by the *Aspergillus* species were studied using slide culture technique. Material was mounted in 10% KOH for the dark pigmented isolates and Amann lactophenol plus cotton blue for the remaining isolates, and all isolates were observed through a Nikon model Labophot light microscope. All measurements are given as an average of 30 of each structure.

The following references were used for identification of the *Aspergillus* isolates: Raper & Fennell (1965); Samson (1979); Christensen & Raper (1978a,b); Christensen (1981); Christensen & States (1982) and Christensen (1982).

Information on geographical distribution and incidence of *Aspergillus* species in Brazil was obtained from the studies by Homrich (1961); Dunn et al. (1989); Araújo et al. (1992); Silva & Minter (1995), who assembled the studies by Batista and coworkers of several Brazilian regions, and Sarquis & Oliveira (1996).

The representative *Aspergillus* spp. cultures studied were preserved in PDA under mineral oil and incorporated in the Fungus Culture Collection of the Departamento de Micologia, Instituto Oswaldo Cruz - Fiocruz (IOC).

Results and Discussion

Two hundred twenty-eight *Aspergillus* strains were isolated, representing 20 species as shown in Table I.

Description of the species

Aspergillus aureolatus Munt.-Cvet. and Bata, in *Bull.Inst. et Jardin Botan.Univ. Beograd* n.s **1**(3): 195-198, 1964.

Illustration: Raper & Fennell (1965)

CZ: colony 3cm in diameter, velvety, azonate. Yellow coloring with orange halo at the margins of the colony and yellow reverse. Amber exudate. Conidiophores erect, short, slender, approximately 125 x 5μm, slightly pigmented. Vesicles globose, 10.5μm and pigmented as the conidiophores. Biseriate phialids. Conidia subglobose delicately echinulated , 3.5-3.7μm.

Representative IOC 3965

The characteristics shown by the examined cultures coincide with the descriptions by Raper & Fennell (1965) and Christensen & States (1982) except for the presence of exudate.

This is the first record of this species in Brazil.

Aspergillus carbonarius (Bainier)Thom, in *J. Agric. Res.* **7**: 12, 1916.

≡ **Aspergillus fonsecaeus** Thom & Raper, in *Manual of the Aspergilli*, p. 227, 1945.

Representative IOC 3973

This strain differs from those described by Raper & Fennell (1965) by its rapid growth and strong yellow reverse since start of growth.

Habitat and geographical distribution in Brazil: In the soil of Trombetas River, Pará (Dunn et al., 1989) and Pernambuco (Batista et al., 1967). In the sand of the beach of Boa Viagem, Recife (Araújo et al., 1992). In fruits of *Punica granatum* in Maranhão (Batista et al., 1967).

Aspergillus flavipes (Bainier & Sartory) Thom & Church, in *Aspergilli*, 155, 1926.

≡ **Sterigmatocystis flavipes** Bainier & Sartory, in *Bull. Soc. Mycol. France* **27**: 90-96, 1911.

The isolated strains presented the same characteristics as those described by Raper & Fennell (1965) for *A.flavipes*.

Habitat and geographical distribution in Brazil: In the soil of the states of Maranhão (Batista et al., 1966), Rondônia (Batista & Lima, 1963), Roraima (Batista & Maciel, 1964) and Pará (Dunn et al., 1989). In sand and water of the beach of Boa Viagem, Recife (Araújo et al., 1992).

Aspergillus flavofurcatus Batista & H.Maia, in *An. Soc. Biol. Pernambuco* **13** 94-96, 1955.

The isolated strains correspond to the description by Raper & Fennell (1965) and Christensen (1981).

Habitat and geographical distribution in Brazil: This species was found as a contaminant of an agar plate in the Instituto de Micologia in Pernambuco (Batista &

Table I: Number of colonies of *Aspergillus* spp. isolated from guts of different triatomids.

Taxon	Triatoma infestans (114)	Triatoma brasiliensis (114)	Triatoma sordida (110)	Triatoma pseudomaculata (110)	Rhodnius prolixus (114)	Rhodnius neglectus (114)	Panstrongylus megistus (114)	Dipetalogaster maximus (114)	Total (904)
A.aureolatus							1		1
A.carbonarius								1	1
A.flavipes					2				1
A.flavofurcatus		5							5
A.flavus	5		2			4	4		15
A.foetidus		4			4				8
A.fumigatus		2		5	3			4	14
A.giganteus		4				1	30	2	37
A.kanagawaensis		2			2				4
A.nidulans	7			1					8
A.niger	1	6	9	5	2		1	2	26
A.niger var.awamori	2	20	9	5	7	4	4	10	47
A.niveus	2		2						4
A.ochraceus	2	5					2	1	10
A.petrakii		4			2				6
A.pulvinus		10							10
A.sclerotiorum	1				4				5
A.sulphureus		4							4
A.sydowi		2			9		2		13
A.versicolor					1				1
A.wentii						3	2	3	8

( ) = number of insect guts assayed

Maia, 1955), in the soil of the margins of the Trombetas River, Pará (Dunn et al., 1989) and in the sand of the beach of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996).

Aspergillus flavus Link, in *Ges. Naturf. Freunde Berlin, Mag. Neuesten Entdeck. Gesammten Naturk.* **3**: 16, 1809.

The isolated strains correspond to the description by Raper & Fennell (1965) and Christensen (1981),except one isolate that has larger conidia than the described these authors.

Habitat and geographical distribution in Brazil: In the soil of Amapá, Maranhão, Rondônia and Roraima (Batista and coworkers, in: Silva & Minter, 1995). In excrement of *Bos* sp., *Capra* sp. and *Ovis* sp. (Batista et al., 1961, 1967b). In the sand of the beach of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996) and also in the sand and water of the beach of Boa Viagem in Recife (Araújo et al., 1992), from air samples in Porto Alegre being second regarding frequency (Homrich, 1961).

Aspergillus foetidus (Naka.)Thom & Raper, in *Man. Aspergilli*: 219, 1945.
≡ **Aspergillus aureus** Nakazawa, in *Inst. Govt. Res. Formosa,* Rept.I, 1907.

CZ: colony 5cm in diameter, floccose azonate. Deep brown coloring and yellow reverse. Strong actinomycete-like smell sometimes present . Conidial heads not numerous, initially greenish brown becoming dark brown and radiate. Conidiophore smooth, erect, hyaline, 772.5 x 8.3µm. Vesicles subglobose with biseriate phialids, both pigmented. Conidia globose, rising in chains without presenting any connectives, 4.5-4.6µm.
Representative IOC 3991

The studied cultures coincide with the description by Raper & Fennell (1965).

This is the first report of this species in Brazil.

Aspergillus fumigatus Fresenius, in *Beitr. Mykol.*: 81, 1863.

All isolated strains correspond to the description by Raper & Fennell (1965), but two of them presented smooth conidia with a greater colony growth than that described. These morphologic variations were accepted by Frisvad & Samson (1990).

Habitat and geographical distribution in Brazil: In the soil of the states of Amapá, Rondônia, Roraima (Batista and coworkers in: Silva & Minter, 1995), São Paulo (Rogers & Beneke, 1963) and Pará (Dunn et al., 1989). In the sand of the beaches of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996) and Boa Viagem, Recife (Araújo et al., 1992). In the excrement of *Bos* sp. in Maranhão (Batista et al., 1966).

Aspergillus giganteus Wehmer, in *Mém. Soc. Phys. Genève* **33** (2): 85-87, 1901.

CZ: colony 7cm in diameter, flocose, azonate. Bluish green coloring with brown reverse. No exudate. Bluish green clavate conidial heads. Conidiophores long, erect, smooth, more than 2cm x 25-31.6µm. Clavate vesicles with a 116.6-173.3 x 36.6-53.3µm diameter and with uniseriate phialids. Conidia elliptical, smooth, 4.5-6 x 3-4µm.
Representative IOC 3960

All isolated strains are typical for the species as described by Raper & Fennell (1965).

Habitat and geographical distribution in Brazil: The first isolation of *A.giganteus* in Brazil was by Dunn et al. (1989) at the margins of the Trombetas River in Pará, but there is no description of the species.

Aspergillus kanagawaensis Nehira, in *J. Jap. Bot.* **26**: 109, 1951.
Illustration: Raper & Fennell (1965)

CZ: colony 4 cm in diameter, dense, cottony, azonate. Grayish brown coloring with bright yellow reverse. Amber-colored exudate. Radiate light brown conidial heads. Conidiophores short, slightly sinuous, 400 x 4µm, with a strong brown pigmentation. Vesicles globose and pigmented, with uniseriate, pigmented phialids. Conidia globose, smooth and slightly pigmented 3-3.2µm.

Representative IOC 3958

The isolated strains correspond to the characteristics of the specie described by Raper & Fennell (1965).

Habitat and geographical distribution in Brazil: The first isolation of *A.kanagawaensis* in Brazil was done by Costa et al. (1993) who isolated several representatives from mosquitoes collected in Rondônia but no description of the species was made.

Aspergillus nidulans (Eidam)G.Winter, in Rabenh.*Krypt.-Fl.*ed.2, **1**(2): 62, 1884.
≡ **Sterigmatocystis nidulans** Eidam, in *Cohn Beitr. Biol. Pflanz.* **3**: 392-411, 1883.

All isolated strains presented similar characteristics to the species described by Raper & Fennell (1965) and Christensen & States (1982).

Habitat and geographical distribution in Brazil: In the soils of the states of Maranhão, Pernambuco (Batista and coworkers in: Silva & Minter, 1995) and Pará (Dunn et al., 1989). In the sand of the beach of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996) and in the water of the beach of Boa Viagem, Recife (Araújo et al., 1992).

Aspergillus niger van Tieghem, in *Ann. Sci. Nat. Bot.*, Ser.5, **8**: 240, 1867.
≡ **Sterigmatocystis nigra** van Tieghem, in *Bull. Soc. Botan. France* **24**: 102-103, 1877.
Illustration: Raper & Fennell, 1965; Ellis, 1971

All isolated strains correspond to the description by Raper & Fennell (1965), except for two isolates which presented smaller conidia (4.2µm), but this measure is mentioned in the description by Ellis (1971), and also because they have a yellow-colored radiate reverse.

Habitat and geographical distribution in Brazil: In the soil of the states of Maranhão, Rondônia, Roraima (Batista and coworkers in: Silva & Minter, 1995) and Pará (Batista and coworkers, Dunn et al., 1989). In the sand of the beaches of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996) and Boa Viagem in Recife (Araújo et al., 1992). The most frequently isolated species in air samples from Porto Alegre (Homrich, 1961). In the water of the beach of Boa Viagem (Araújo et al., 1992), in addition to several other substrates such as animal excrement and in human material (Batista and coworkers in: Silva & Minter, 1995).

Aspergillus niger van Tieghem var. ***awamori*** (Nakazawa)Al Musallam in *Revision of the black **Aspergillus** species. PhD Thesis, Univ. of Utrecht. 1980.*

≡ **Aspergillus awamori** Nakazawa, in *Rep. Gov. Res. Inst. Formosa* 1907: 1, 1907.

All isolated strains coincide with the description of *A.awamori* by Raper & Fennell (1965).

Habitat and geographical distribution in Brazil: In the soil of the margins of the Trombetas River, Pará (Dunn et al., 1989); in Rondônia (Batista & Peres, 1964) and in the sand of the beaches of Boa Viagem in Recife (Araújo et al., 1992) and Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996).

Aspergillus niveus Blochwitz, in *Ann. Mycol.* **27**: 205, 1929.
≡ **Sterigmatocystis pusilla** Peyronel, in *I germi atmosferici dei funghi con micelio, Thesis,* Padova, p. 21, 1931.
Representative IOC 3935

The isolated strain corresponds to the description of *A.niveus* by Raper & Fennell (1965).

Habitat and geographical distribution in Brazil: In the soil of Pernambuco (Ramos & Upadhyay in: Silva & Minter, 1995).

Aspergillus ochraceus K.Wilhelm, in *Beitr. Kenntn.* Aspergillus: 66, 1877.
≡ **Aspergillus ochraceo-petaliformis** Batista & Maia, in *An. Soc. Biol. Pernambuco* **15**(1): 217-218, 1957.

All isolated strains correspond to the characteristics described by Raper & Fennell (1965) and Christensen (1982).

Habitat and geographical distribution in Brazil: In the soil of the margins of the Trombetas River, Pará (Dunn et al., 1989). In the sand of the beach of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996) and as a contaminant of an agar plate in Pernambuco (Batista & Maia, 1957).

Aspergillus petrakii Vöros, in *Sydowia, Ann. Mycol.* Ser.II, Beihfte **1**, p. 61-63, 1957
Representative IOC 3954

Two isolates of this species did not correspond to the description by Raper & Fennell (1965) because they presented larger vesicles (41.9 x 29.8µm); however, according to Christensen (1982) the size of the vesicle may reach up to 45µm.

Habitat and geographical distribution in Brazil: In the sand of the beach of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996).

Aspergillus pulverulentus (Mc Alpine) Wehmer, in *Centralbl. Bakteriol., 2. Abth,***18**: 394, 1907.
≡ **Sterigmatocystis pulverulenta** Mc Alpine, in *Agr. Gaz. N. S. Wales* **7**: 302, 1896.

CZ: colony 3.8cm in diameter, flocose and dense. Black coloring with white margins. Reverse without pigment. Conidial heads abundant, black, radiated, mainly close to the margins of the colony. Conidiophores erect, over 2mm long, hyaline at the basal part and light yellow close to the vesicle. Vesicle globose, biseriate with brownish phialids. Conidia globose, with quite visible brown ornaments, 4.9µm.
Representative IOC 4084

The morphological characteristics of the studied cultures correspond to the description by Raper & Fennell (1965).

This species is described for the first time in Brazil.

Aspergillus pulvinus Kwon-Chung & Fennell, in *The genus Aspergillus*, p. 45, 1965.
Illustration: Raper & Fennell (1965)

CZ: colony 2.8cm in diameter, flocose, presence of a "puff"at the center of the colony. Bluish green coloring with white margins. Greenish brown reverse and no exudate. Conidial heads abundant, bluish green, globose, mainly in the center of the colony. Conidiophores pigmented, wrinkled, 700 x 8µm. Vesicles elongated, completely covered with metulae phialids. Conidia globose, green echinulated 3.5µm.
Representative IOC 3957

Raper & Fennell (1965) described this species with and abundant brown exudate, but none of our isolates produced an exudate. Similarly, Klich (1993) does not mention this characteristic for this species.

This species is newly recorded in Brazil.

Aspergillus sclerotiorum Huber, in *Phytopathol.* **23**: 306, 1933.
Representative IOC 3988

All isolated strains correspond to the description by Raper & Fennell (1965), with one isolate presenting larger vesicles than their description specifies, but Christensen (1982) accepts any variation in vesicle size less than a 40µm diameter.

Habitat and geographical distribution in Brazil: In the soil of the states of Maranhão, Pernambuco, Rondônia (Batista and coworkers in: Silva & Minter, 1995) and Rio de Janeiro (Sarquis & Oliveira, 1996) and in the water of the beach of Boa Viagem, Recife (Araújo et al., 1992).

Aspergillus sulphureus (Fresenius)Wehmer, in *Mém. Soc. Phys. Genève*,**33(2)**: 113. 1901.
≡ **Sterigmatocystis sulphurea** Fresenius, in *Beitr. Mykol.* **3**: 83, 1863.

All isolated strains correspond to the characteristics of the species described by Raper & Fennell (1965) and Christensen (1982) except for a strain which had smaller vesicles than the descrption indicated
Representative IOC 3952

Habitat and geographical distribution in Brazil: In the soil of the states of Maranhão, Pernambuco and Rondônia (Batista and coworkers in: Silva & Minter, 1995) and in the sand of the beach of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996).

Aspergillus sydowii (Bainier & Sartory) Thom & Church, *Aspergilli*, 147, 1926.
≡ **Sterigmatocystis sydowi** Bainier & Sartory, in *Ann. Mycol.* **11**: 25-29, 1913.

All isolated strains correspond to the description by Raper & Fennell (1965), with one strain presenting vesicles smaller than the described range, but in the morphological studies by Klich (1993), this variation of size is accepted.

Habitat and geographical distribution in Brazil: In the soil of the states of Maranhão, Rondônia (Batista et al., 1964, 1966) and Pernambuco (Araújo et al., 1992).

Aspergillus versicolor (Vuill.) Tiraboshi, in *Ann. Bot. (Roma)* **7**: 9, 1908.
≡ **Sterigmatocystis versicolor** Vuillmin, B. Mirsky, *Thèse de Médecine*, Nancy, n° 27, p. 15, 1903.
Representative IOC 3994

All studied strains coincide with the description by Raper & Fennell (1965) and Klich (1993).

Habitat and geographical distribution in Brazil: In the soil of the states of Amapá, Maranhão, Rondônia (Batista and coworkers in: Silva & Minter, 1995), Pará (Dunn et al., 1989) and Rio de Janeiro (Sarquis & Oliveira, 1996). In the water of the beach of Boa Viagem, Recife (Araújo et al., 1992). In the atmosphere in Porto Alegre (Homrich, 1961) and several substrates such as animal excrement, human material and gills of native fishes in Pernambuco (Batista et al., 1955, 1965, 1966).

Aspergillus wentii Wehmer, in *Centralbl.Bakteriol.,*2, Abth, 2: 149, 1896.

All isolated specimens correspond to the description of the species by Raper & Fennell (1965).

Habitat and geographical distribution in Brazil: In the soil of the states of Maranhão and Paraíba (Batista and coworkers in: Silva & Minter, 1995). In the sand of the beaches of Ipanema, Rio de Janeiro (Sarquis & Oliveira, 1996) and Boa Viagem, Recife (Araújo et al., 1992).

- All *Aspergillus* species which we isolated during this study, except for *A.versicolor*, isolated by Cavanagh & Marsden (1969) from the digestive tract of three *R.prolixus* species, are newly recorded fungi associated with triatomids, but these species are widely found in nature in different substrates.
- *A.niger* var.*awamori, A.flavus, A.fumigatus, A.niger* and *A.giganteus* were the species which occurred most (Table I). *A.flavus* and *A.niger* are cited in the literature as being species associated with different types of insects (Gilliam et al., 1974, 1977, 1990; Prest et al., 1974; Ismail & Abdel-Sater, 1993; Shoreit & Bagy, 1995) and some of them are entomopathogenic (Roberts & Humber, 1989; Alves, 1986). *A.fumigatus* is also found in insects but with a reduced frequency (Gilliam et al., 1977; Ismail & Abdel-Sater, 1993). *A.*niger var. *awamori* and *A.giganteus* up to now were not found in the literature to be associated with insects.
- From all the species isolated, *A.carbonarius, A.flavipes, A.flavus, A.fumigatus, A.nidulans, A.niger, A.niger* var. *awamori* , *A.sclerotiorum, A.sulphureus, A.sydowi* and *A.versicolor* are common in soil and air in Brazilian states, such as Pará, Rondônia, Roraima, Pernambuco, Bahia and São Paulo, where areas of Chagas'disease are identified (Barreto, 1976). The triatomids live in holes in trees and soils where armadillos live, so the incidence of these cited *Aspergillus* species in the digestive tract of these insects could be explained by their common incidence in soils.

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ANAMORPHIC MORPHOLOGY OF *UNCINULA* AND ALLIED GENERA (I)

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ABSTRACT: Morphological characteristics of the anamorphic states in 23 species of the genus *Uncinula* and allied genera are described and illustrated. All species examined produced conidia singly, but the morphology of foot-cells in conidiophores was variable and of taxonomic value. Furthermore, the position of the conidiophores on their mother cells, central or non-central, was newly found to be stable in different species and proposed for the first time as an important criterion for classifying species.

Key words: anamorphs, powdery mildews, *Furcouncinula*, *Uncinula*, *Uncinuliella*

INTRODUCTION

The taxonomy of the powdery mildews is usually based on morphological characteristics of the perithecia, perithecial wall-cells, asci, ascospores, and perithecial appendages produced by their teleomorphs (Braun, 1987; Zheng & Yu, 1987). However, their anamorphic features also attracted some attention as taxonomic characteristics (Zaracovitis, 1965; Boesewinkel, 1979, 1980; Shin, 1988). Though several works on the anamorphic taxonomy of powdery mildews have been published, the present knowledge is far from being complete. Many conidial states have not been described and are, therefore, unknown till now, because most of the original descriptions of the teleomorphic states are unfortunately not accompanied by adequate information on the corresponding anamorphic states.

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The genus *Uncinula* sensu Léveille was divided into several genera, viz., *Bulbouncinula*, *Furcouncinula*, *Sawadaia*, *Uncinula*, and *Uncinuliella*, mainly based on the morphological differences of perithecial appendages (Sawada, 1914; Zheng & Chen, 1979a, 1979b; Chen *et al.*, 1982). The anamorphic morphology of this group has only been studied poorly. Furthermore, many new species of *Uncinula* and allied genera have been established in recent years (Zheng & Chen, 1977a, 1977b, 1978; Chen *et al.*, 1982; Xu & Ge, 1983; Chen *et al.*, 1984; Nomura & Tanda, 1985; Xie, 1987; Lu & Wang, 1987; Yu, 1993; Dianese & Dianese, 1995), mostly without mentioning their corresponding anamorphic features.

In the present work, the anamorphic morphology of various species of *Uncinula* and allied genera is described with the purpose to prepare a diagnostic key to the species. Herbarium material deposited in HMAS (Mycological Herbarium of the Institute of Microbiology, Academia Sinica, China) and SMK (Mycological Herbarium, Department of Agricultural Biology, Korea University, Korea) has been examined by lactic acid technique (Shin, 1988).

The authors follow the species concept outlined by Braun (1987) and Zheng & Yu (1987), as well as Boesewinkel's (1980) terminology for describing the anamorphic states. In this paper, a new term, 'coral-shaped appressoria', is introduced to describe the multilobed, branched, large appressoria shown in Fig. 2, 15 and 22. The position of conidiophores on hyphae has never been considered to be a character of taxonomic value in powdery mildews. Preliminary examinations revealed that some species produce their conidiophores in the middle between two hyphal septa and some laterally displaced. Therefore, the position of conidiophores on the mother cell, central or non-central, is regarded as an important new character for the species classification.

The position of germ tubes on conidia is mostly described to be formed 'at the end' or 'at the side'. In this paper, we prefer to use the word 'shoulder' instead of 'end', because the real position of the germ tubes in powdery mildew conidia is usually not the outermost end but the shoulder as illustrated in many papers (Boesewinkel, 1980; Shin, 1988; Nomura, 1992). Furthermore, some species of powdery mildews produced their germ tubes just beneath the shoulder as shown in Fig. 7, 19, and 22, for which the expression 'below the shoulder' is used.

OBSERVATIONS

1. *Furcouncinula wuyiensis* Z. X. Chen & Gao Fig. 1

Amphigenous, but usually hypophyllous, also cauligenous, effuse, evanescent to subpersistent; mycelial cells 40-65 x 4-6 μm, branching at right angles, with a septum at the branching point; appressoria small, moderately lobed, single or opposite; conidiophores single on a hyphal cell, 50-68 x 7-8 μm, arising from the upper part of the mother cell, position central, producing conidia singly, followed by (2-)3 cells, straight at the foot-cell, with a basal septum at the branching point; conidia oval, 25-31 x 11-14 μm, producing germ tubes on the shoulder(s) with lobed appressorium.

Specimen examined: HMAS 41443 (isotype, on *Carpinus fargesis* Franch. var. *macrostachya* Hu)

Notes: The anamorphic characteristics of this species were not described by either Chen *et al.* (1982) or Zheng & Yu (1987). This is the first description of the morphology of the imperfect state. No characteristics for the differentiation of this genus from *Uncinula* s. str. in the conidial state could be found.

2. *Uncinula adunca* (Wallr.: Fr.) Lév. var. *adunca* Fig. 2

Amphigenous, dense, effuse to forming white patches, at last confluent and covering the entire surface of leaves; mycelial cells 46-60(-90) x 6-8 μm, but as short as 24-40 μm when having appressoria, branching at right angles, usually with a septum at the branching point; appressoria multilobed to coral-shaped, opposite or single; conidiophores single on a hyphal cell, 50-80 x 6-8 μm, arising from the upper part of the mother cell, position central, producing conidia singly, followed by 2-3 cells, straight at the foot-cell, with a basal septum at the branching point; conidia oval to cylindric oval, 26-30 x 11-13 μm, producing germ tubes on the shoulder, usually on both ends, short, with lobed terminal appressorium.

Specimens examined: HMAS 36401 (on *Populus cathayana* Rehd.), 36425 (on *Salix* sp.); SMK 12109, 13045, 13085, 13415, 13705 (all on *Salix* sp.), 10224, 11064, 11252, 13181 (all on *Salix gracilistyla* Miq.)

Notes: Several workers have described the anamorphic morphology of this species (Sawada, 1914; Homma, 1937; Nomura, 1992). Their descrip-

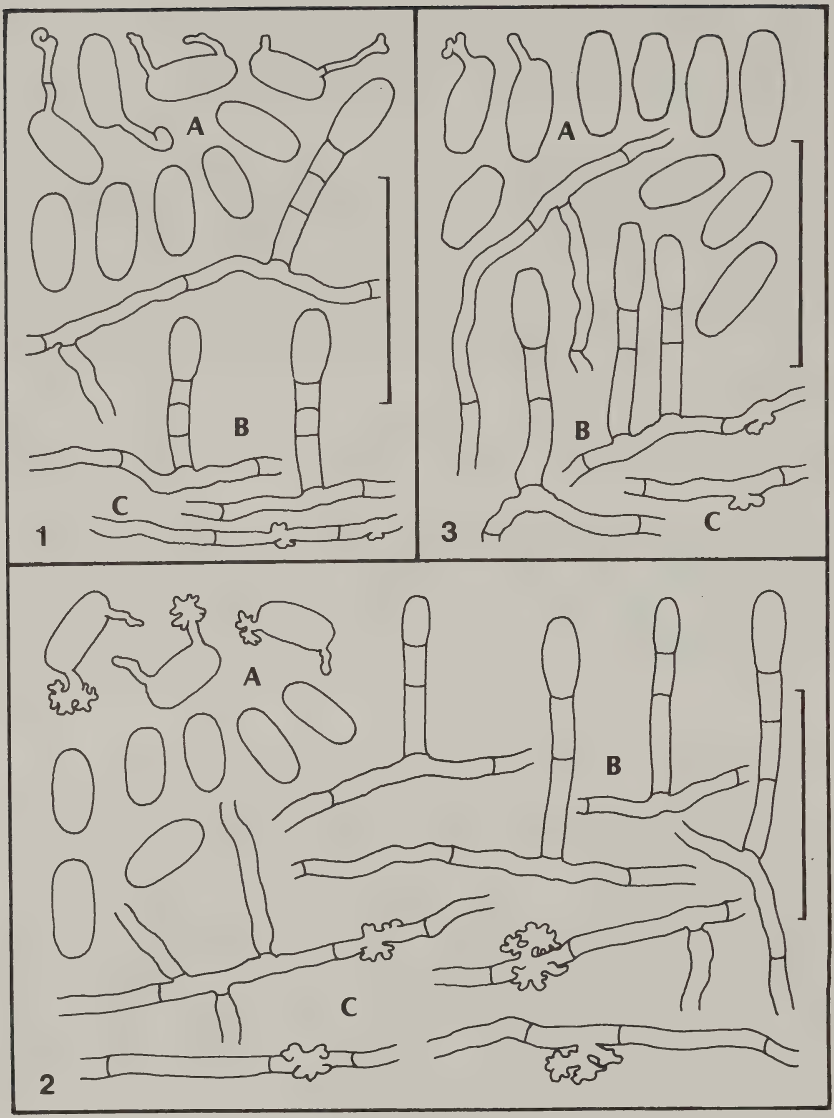


Fig. 1. *Furcouncinula wuyiensis* Z. X. Chen & Gao
Fig. 2. *Uncinula adunca* (Wallr.: Fr.) Lév. var. *adunca*
Fig. 3. *Uncinula alangii* T. Xu
A. Conidia with or without germ tubes; **B**. Conidiophores; **C**. Mycelium with or without appressoria. H. D. Shin del. (Bar = 50 μm)

tions and drawings are in accordance with the present observation. The measurements of our materials are generally smaller in size than the previous records, possibly due to the shrinkage of conidia and conidiophores in old herbarium material, but the general characteristics agree well.

3. *Uncinula alangii* T. Xu Fig. 3

Amphigenous, but mostly epiphyllous, evanescent to subpersistent, effuse to forming irregular patches; mycelial cells 40-65 x 4-6 μm, branching at right angles, with a septum at the branching point; appressoria multilobed; conidiophores 1-2 on a hyphal cell, 55-65 x ca 7 μm, arising from the upper part of the mother cell, position central or non-central(2:1), producing conidia singly, followed by 2 cells, straight at the foot-cell, with a basal septum at the branching point; conidia cylindric oval to barrel-shaped, 26-35 x 12-14 μm, producing germ tube on the shoulder with multilobed appressorium.

Specimen examined: HMAS 44236 [isotype, on *Alangium platanifolium* (S. & Z.) Harms]

Notes: The original description of the species published by Xu & Ge (1983) was not accompanied by the corresponding anamorphic state. This is the first description of the anamorphic characteristics of this fungus.

4. *Uncinula alchorneae* var. *elliptispora* Zheng & Chen Fig. 4

Amphigenous, but mostly epiphyllous, thinly effuse on the lower surface but forming patches on the upper surface of leaves; mycelial cells 40-65 x 4-5 μm, branching at right angles, usually with a septum at the branching point; appressoria moderately lobed to multilobed, opposite or single; conidiophores single on a hyphal cell, 94-140 μm long, 4-5 μm wide at the foot-cell but broader upwards, up to 9 μm below the uppermost cell, arising from the upper part of the mother cell, position central, producing conidia singly but sometimes in short chains, followed by 1-2 cells and a long slender straight foot-cell, with a basal septum at the branching point; conidia oval, 26-32 x 12-15 μm, producing germ tube on the shoulder with multilobed appressorium.

Specimen examined: HMAS 36489 (type, on *Alchornea davidii* Franch.)

Notes: The anamorphic characteristics were not described by Zheng &

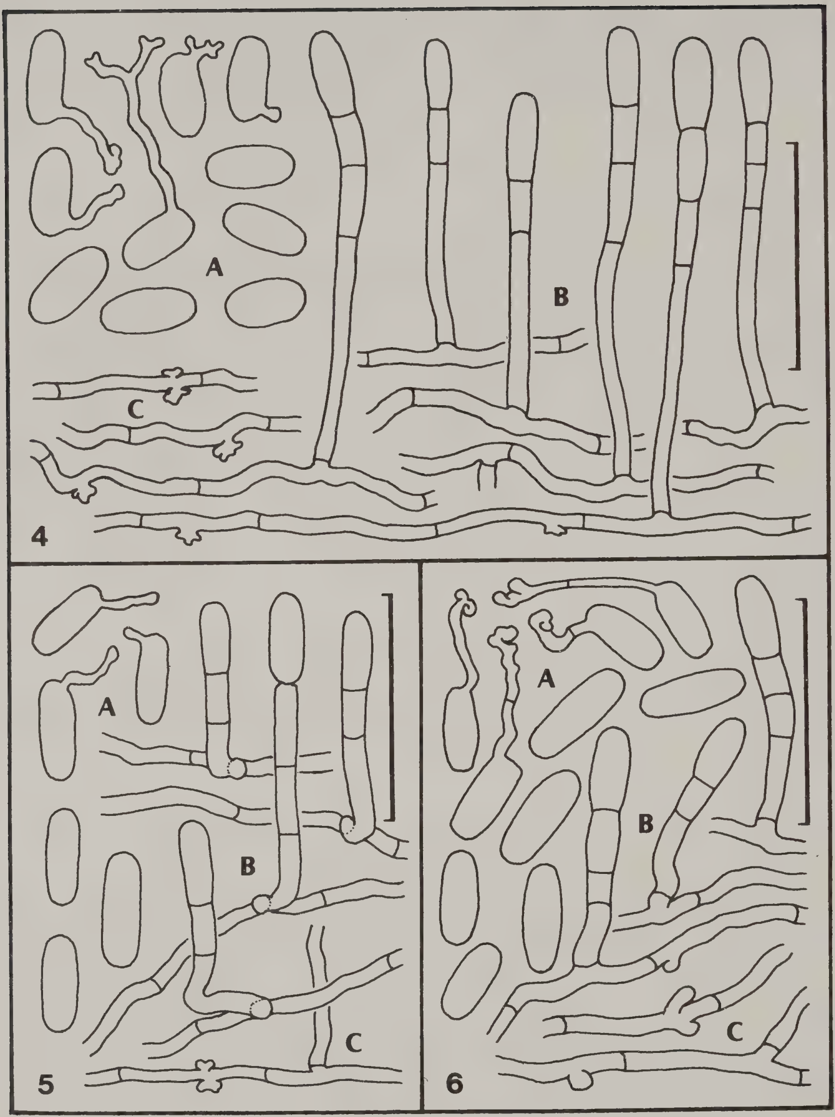


Fig. 4. *Uncinula alchorneae* var. *elliptispora* Zheng & Chen
Fig. 5. *Uncinula cedrelae* Tai
Fig. 6. *Uncinula clintoniopsis* Zheng & Chen
A. Conidia with or without germ tubes;
B. Conidiophores; **C**. Mycelium with or without appressoria. H. D. Shin del. (Bar = 50 μm)

Chen (1977b). The present fungus is characterized by its long, slender conidiophores with long foot-cells. The diameter of the conidiophores increases from 4-5 µm at the foot-cell to 6-9 µm below the uppermost cell.

5. *Uncinula cedrelae* Tai Fig. 5

Amphigenous, usually subpersistent forming white patches on the upper surface but evanescent and thinly effuse on the lower surface of leaves; mycelial cells 50-60(-75) x 4-6(-7) µm, branching at right angles, usually with a septum at the branching point; appressoria moderately lobed to multilobed, opposite or single; conidiophores single on a hyphal cell, 54-98 x 7-8 µm, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position non-central (2-3:1), producing conidia singly, followed by 2(-3) cells, straight at the foot-cell, with a basal septum at the branching point; conidia oblong to cylindric, 30-36 x 10-13 µm, producing germ tubes on the shoulder.

Specimens examined: HMAS 37693; SMK 10251, 13612 [all on *Toona sinensis* (A. Juss) Roem.]

Notes: Shin's (1990) description of the anamorphic state of this species could be confirmed by the present observations.

6. *Uncinula clintoniopsis* Zheng & Chen Fig. 6

Hypophyllous, occasionally amphigenous, thinly effuse, evanescent; mycelial cells 40-65 x 4-5 µm, branching at right angles, usually with a septum at the branching point; appressoria not lobed but dome- to hook-shaped, single or opposite; conidiophores single on a hyphal cell, 60-86 x 7-8 µm, sometimes broader upwards, up to 11 µm below the uppermost cell, arising from the upper part of the mother cell, position central, producing conidia singly, followed by 2-3 cells, straight at the foot-cell but sometimes slightly flexuous at the base of the foot-cell, with a basal septum at the branching point; conidia cylindric oval to barrel-shaped, 26-38 x 11-14 µm, producing germ tube(s) on the shoulder with lobed appressorium.

Specimens examined: HMAS 11454 (type), 40316 [both on *Firmiana simplex* (L.) W. F. Wight]

Notes: Zheng & Chen (1977b) only described 'cylindric conidia, 27.0-39.5 x 12.5-16.7 µm'. The present fungus is characterized by its dome- to hook-shaped appressoria. This type of hyphal appressoria has also been observed by I. Pascoe (1994, personal communication) in *Erysiphe cichoracearum* on Asteraceae.

7. *Uncinula coriariae* Zheng & Chen Fig. 7

Amphigenous, conspicuous, persistent, effuse to forming thick patches; mycelial cells 40-65 x 4-6 μm, branching at right angles, usually with a septum at the branching point; appressoria moderately lobed, opposite or single; conidiophores single on a hyphal cell, 54-74 x 6-8 μm, usually broader upwards to 8-10 μm below the uppermost cell, arising from the upper part of the mother cell, position central, producing conidia singly, followed by 2-3 cells, straight at the foot-cell, with a basal septum at the branching point; conidia oval to cylindric oval, 26-34 x 11-14 μm, producing germ tube below the shoulder with multilobed appressorium.

Specimen examined: HMAS 36505 (type, on *Coriaria sinica* Maxim.)

Notes: The anamorphic characteristics were not described by Zheng & Chen (1977b) in the original description. This fungus is characterized by producing germ tube below the shoulder of conidia.

8. *Uncinula dabashanensis* Zheng & Chen Fig. 8

Amphigenous, conspicuous, persistent, effuse to forming white patches; mycelial cells 40-65 x 3-5 μm, branching at right angles, with a septum 0-8 μm above the branching point; appressoria moderately lobed to multilobed, single or opposite; conidiophores single on a hyphal cell, 52-86 x 5-6 μm, usually broader upwards, up to 8-9 μm below the uppermost cell, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position central to non-central(2:1), producing conidia singly, followed by 2-3 cells, with a basal septum at the branching point; conidia oblong to cylindric, 21-32 x 8-11 μm, containing conspicuous oil drops, producing germ tube on the shoulder(s) with multilobed appressorium.

Specimen examined: HMAS 24971 [type, on *Litsea populifolia* (Hemsl.) Gamble]

Notes: The anamorphic features were not mentioned by Zheng & Chen (1978) in the original description. The present fungus is characterized by conidiophores with curved foot-cell and cylindric conidia with oil

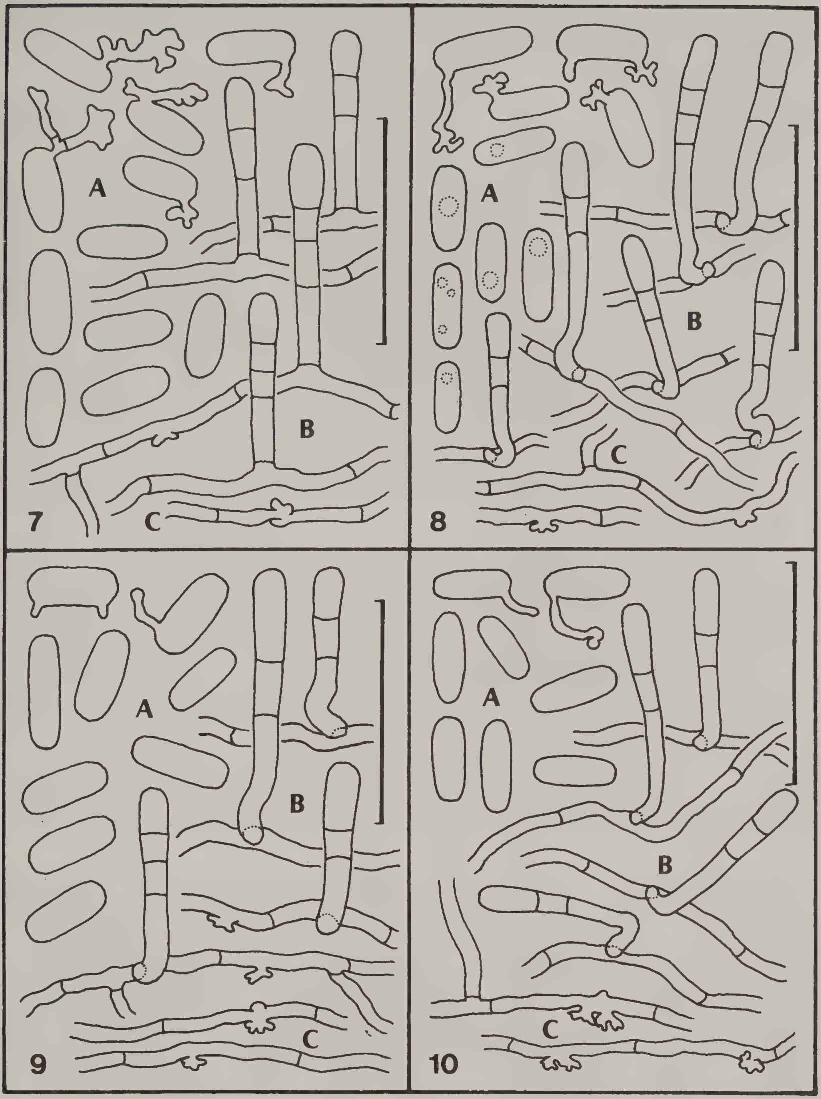


Fig. 7. *Uncinula coriariae* Zheng & Chen
Fig. 8. *Uncinula dabashanensis* Zheng & Chen
Fig. 9. *Uncinula ehretiae* Keissler
Fig. 10. *Uncinula evodiae* Zheng & Chen
A. Conidia with or without germ tubes;
B. Conidiophores; **C**. Mycelium with or without appressoria. H. D. Shin del. (Bar = 50 μm)

droplets. The morphological features of the anamorphic state are similar to those of *U. verniciferae*.

9. *Uncinula ehretiae* Keissler Fig. 9

Amphigenous, but mostly epiphyllous, conspicuous, persistent to subpersistent, forming white patches; mycelial cells 40-60 x 4-6 μm, branching at right angles, with a septum at the branching point; appressoria moderately lobed to multilobed, opposite or single; conidiophores single on a hyphal cell, 56-88 x ca 8 μm, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position central, producing conidia singly, followed by 2-3 cells, with a basal septum at the branching point; conidia oblong to cylindric oval, 26-32 x 10-13 μm, producing germ tube(s) on the shoulder.

Specimens examined: HMAS 01287, 02972 (both on *Ehretia corylifolia* C. H. Wright)

Notes: Tai (1946) described the anamorphic characteristics of the species as follows: 'conidiophores 3-celled, curved at the basal part, 26-40 x 7 μm; conidia solitary, oblong or cylindrical, 30-33 x 11-13 μm'. Our examinations are in accordance with his description. This report gives additional information of taxonomic value by describing the mycelial morphology and conidiophore position on the mother cell.

10. *Uncinula evodiae* Zheng & Chen Fig. 10

Amphigenous, but mostly hypophyllous, persistent, forming conspicuous white patches; mycelial cells 35-65 x 3-5 μm, branching at right angles, with a septum at the branching point; appressoria multilobed, opposite or single; conidiophores single on a hyphal cell, 60-74 x 5-6 μm, slightly broader upwards, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position central, producing conidia singly, followed by 2 cells, with a basal septum at the branching point; conidia oblong to cylindric oval, 22-30 x 9-11 μm, producing germ tube on the shoulder.

Specimen examined: HMAS 38960 [type, on *Evodia daniellii* (Benn.) Hemsl.]

Notes: Zheng & Chen (1981) described the conidial state of the fungus as follows: 'conidia in chains, subcylindric to obtusely cylindric, 27.0-39.5 x 10.4-14.6 μm'. In the present study, additional characteristics of the anamorphic state are given.

11. *Uncinula hydrangeae* Z. X. Chen & Gao   Fig. 11

Amphigenous, but usually epiphyllous, evanescent to subpersistent, effuse to forming white patches; mycelial cells 40-70 x 4-6 µm, but as short as 30-45 µm when having appressoria, branching at right angles, with a septum at the branching point; appressoria small, moderately lobed, usually single; conidiophores single on a hyphal cell, 60-86 x ca 9 µm, arising from the upper part of the mother cell, position central, producing conidia singly, followed by 3 cells, straight at the foot-cell, with a basal septum at the branching point; conidia oval to barrel-shaped, 24-31 x 11-14 µm, producing narrow germ tube on the shoulder.

Specimen examined: HMAS 44237 (isotype, on *Hydrangea paniculata* Sieb.)

Notes: Nomura & Tanda (1985) described the anamorphic morphology of this species collected in Japan as follows: 'conidiophores erect, hyaline, 1-2-septate and moreover 1-septate at the base; conidia solitary, ovate or broadly ellipsoid, hyaline, 28-43 x 15-22 µm'. Nomura (1992) added some morphological data of the conidiophores: 'arising from the upper part of hyphae, erect, 45-90 x 8-10 µm, 1-2-septate (except the basal septum), foot-cell 20-45 x 8-10 µm'. The present examination of Chinese material is in accordance with their records, but the conidia have been smaller than those of the Japanese material possibly due to the dried old shrunk herbarium material used for the measurements.

12. *Uncinula mori* Miyake   Fig. 12

Amphigenous, but mostly epiphyllous, thinly effuse on the lower surface or persistent, forming white patches on the upper surface of leaves; mycelial cells 56-98 x 4-6 µm, but as short as 32-46 µm when having appressoria, branching at right angles, usually with a septum at the branching point; appressoria multilobed to moderately lobed, opposite or single; conidiophores 1(-2) on a hyphal cell, 80-94 x 8-9 µm, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position non-central(2-5:1), producing conidia singly, followed by 3 cells, straight at the foot-cell, with a basal septum at the branching point; conidia ellipsoidal, 28-32 x 16-18 µm, producing germ tube on the shoulder.

Specimens examined: HMAS 40318 (on *Morus alba* L.), 38792 (on *Morus*

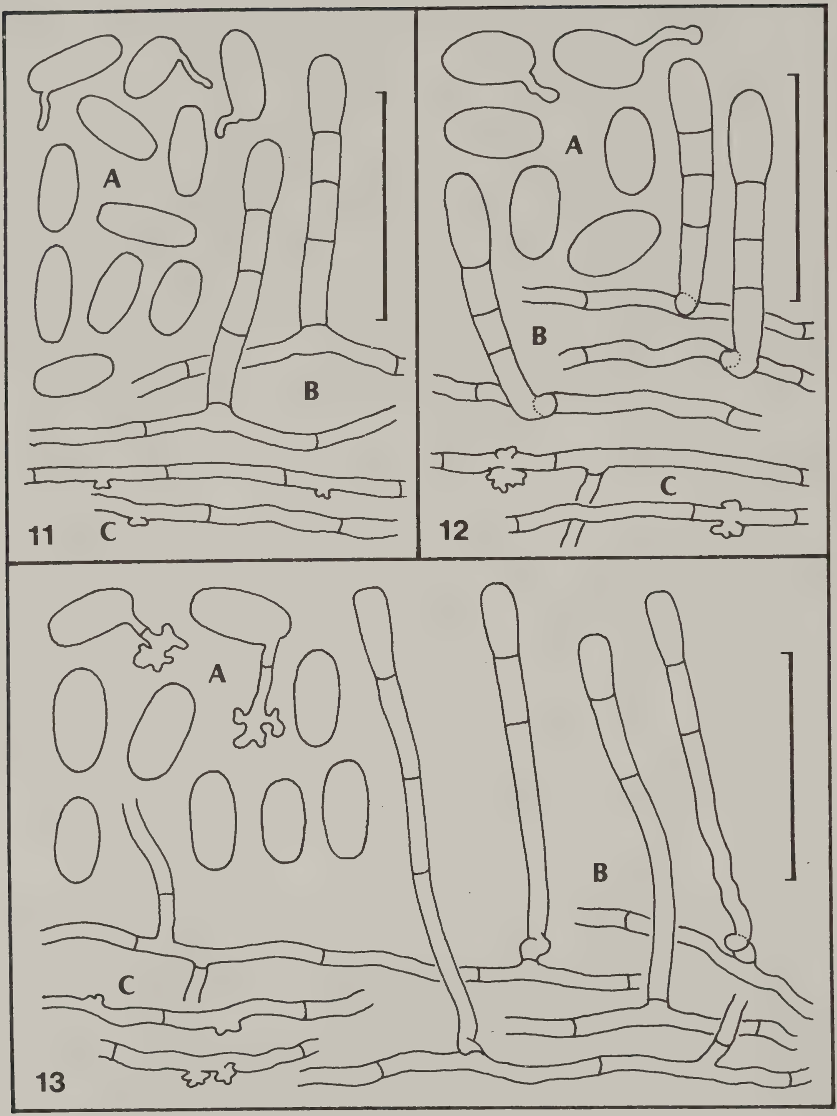


Fig. 11. *Uncinula hydrangeae* Z. X. Chen & Gao
Fig. 12. *Uncinula mori* Miyake
Fig. 13. *Uncinula necator* (Schwein.) Burr.
A. Conidia with or without germ tubes;
B. Conidiophores; **C**. Mycelium with or without appressoria. H. D. Shin del. (Bar = 50 μm)

australis Poir.)

Notes: Nomura (1992) described the anamorphic morphology of the species as follows: 'conidiophores arising from the upper part or sometimes from the side of hyphae, erect, 58-90 x 8-12 μm, 1-2-septate (except the basal septum), foot-cell 30-44 x 8-10 μm, narrowed or abruptly curved at the base of foot-cell; conidia formed singly, ellipsoidal to cylindric ellipsoidal, 35-45 x 16-20 μm'. Our observations are in accordance with his description, but in the material examined here all conidiophores are eccentrically produced on the mother cells and with curved (L-shaped) foot-cells. The conidial size of our material is smaller than the Japanese values, possibly due to the shrinkage of herbarium material examined. In the present work, information concerning mycelial morphology and position of conidiophore on the mother cell, is added.

13. *Uncinula necator* (Schwein.) Burr. Fig. 13

Amphigenous, but mostly epiphyllous, also on inflorescences and fruits, persistent to subevanescent, usually forming thick white patches; mycelial cells 30-70 x 4 μm, branching at right angles, usually with a septum at 0-15 μm above the branching point; appressoria multilobed to moderately lobed, opposite or single; conidiophores 1-2(-3) on a hyphal cell, up to 200 μm long, 6-7 μm wide, broader upwards, up to 7-10 μm below the uppermost cell, arising from the upper part of the mother cell, position central to non-central(2:1), moderately to extremely flexuous or twisted at the base of the foot-cell, producing conidia singly, followed by 2-3 cells, with a basal septum at the branching point; conidia oval, 27-34 x 14-17 μm, producing germ tube on the shoulder with multilobed appressorium.

Specimens examined: HMAS 35456; SMK 10010 (all on *Vitis vinifera* L.)

Notes: Weltzien & Yarwood (1963), Boesewinkel (1979) and Nomura (1981) have studied the anamorphic morphology of this species. The present observations are in accordance with the previous works and additional characteristics of taxonomic value including branching habit of mycelia and position of conidiophore on hyphae have been found.

14. *Uncinula oleosa* Zheng & Chen Fig. 14

Amphigenous, but mostly epiphyllous, subpersistent, thinly effuse; mycelial cells 40-60 x 4-5 μm, branching at right angles, with a septum at the branching point; appressoria multilobed to moderately lobed, opposite or single; conidiophores 1-2 on a hyphal cell, 50-66 x 6-8 μm, arising from the upper part of the mother cell, position usually central, producing conidia singly, followed by 2 cells, with a basal septum at the branching point; conidia oblong to cylindric, 29-36 x 9-12 μm, producing germ tube on the shoulder with multilobed appressorium.

Specimen examined: HMAS 36490 (type, on *Tilia tuan* Szyszyl.)

Notes: The anamorphic characteristics of this fungus have not been described by either Zheng & Chen (1977b) or Nomura (1992). This fungus was included in *Uncinula miyabei* (Salmon) Sacc. & Sydow by Homma (1937) and later Zheng & Chen (1977b) treated it as a new species based on different perithecial appendages. The anamorphic morphology of the present species was also found to be different from those of *U. miyabei*, which has larger ellipsoidal conidia and curved foot-cells of the conidiophores (Nomura, 1992; Shin, unpublished)

15. *Uncinula regularis* Zheng & Chen Fig. 15

Hypophyllous, evanescent to subpersistent, thinly effuse; mycelial cells 40-60(-80) x 4-6 μm, but only 25-40 μm long when having appressoria, sometimes swollen, up to 10 μm wide, branching at right angles, with a septum at the branching point; appressoria multilobed to coral-shaped, single or in groups; conidiophores single on a hyphal cell, 45-65 x 7-8 μm, usually swollen, up to 10 μm at the base and abruptly constricted at the branching point, arising from the upper part of the mother cell, position central to non-central(2:1), producing conidia singly, followed by 2 cells, with a basal septum at the branching point; conidia oval to cylindric oval, 26-32 x 10-13 μm, producing germ tube(s) on the shoulder with multilobed appressorium.

Specimen examined: HMAS 36485 (on *Salix caprea* L.)

Notes: The anamorphic characteristics of the fungus have not been described by Zheng & Chen (1977a) in the original description. The anamorphic features of this species are very close to those of *U. adunca*, but differ in having conidiophores with constricted bases.

16. *Uncinula salmonii* H. & P. Sydow Fig. 16

Amphigenous, but mostly epiphyllous, persistent to subpersistent, effuse to forming white patches, at last covering the whole leaf surface

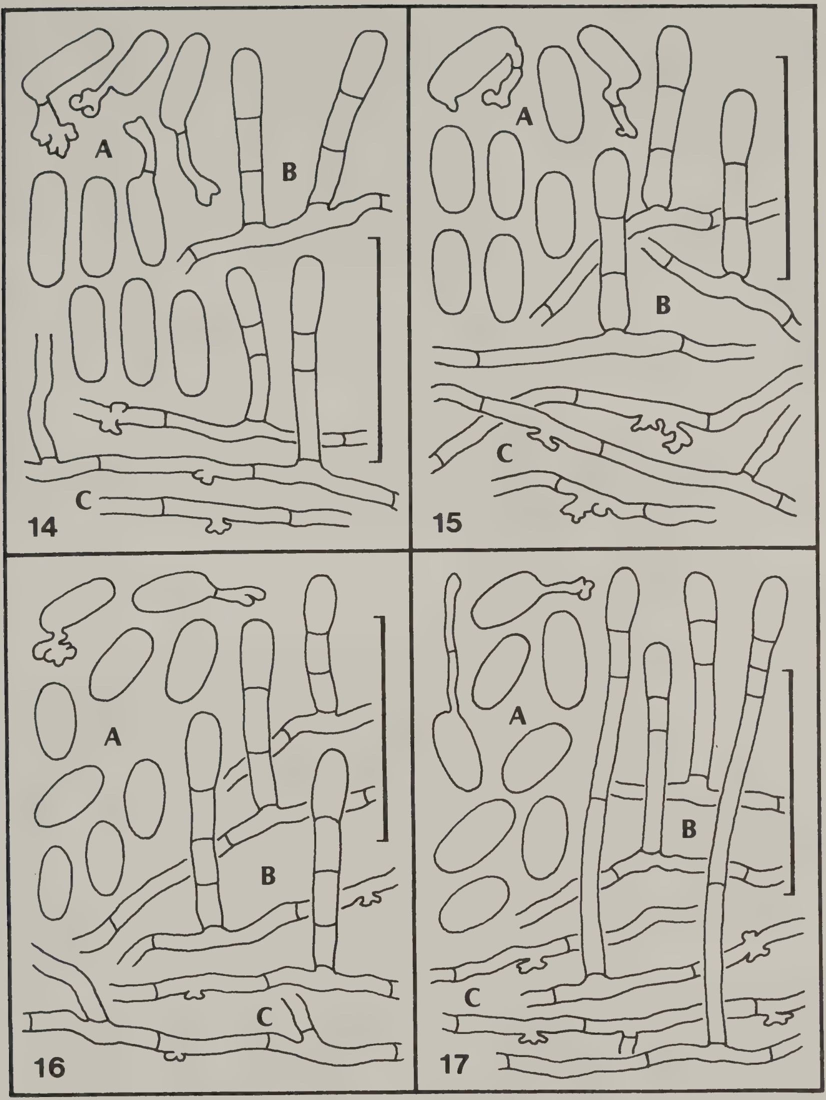


Fig. 14. *Uncinula oleosa* Zheng & Chen
Fig. 15. *Uncinula regularis* Zheng & Chen
Fig. 16. *Uncinula salmonii* H. & P. Sydow
Fig. 17. *Uncinula sapindi* S. R. Yu
A. Conidia with or without germ tubes;
B. Conidiophores; **C**. Mycelium with or without
appressoria. H. D. Shin del. (Bar = 50 μm)

of the both sides; mycelial cells 26-35(-60) x 4-5 μm, sometimes swollen, up to 9 μm wide, branching at right angles, usually with a septum at the branching point; appressoria small, moderately lobed, usually single; conidiophores single on a hyphal cell, 45-70 x 7-8 μm, arising from the upper part of the mother cell, position central to non-central(2:1), producing conidia singly, followed by 2-3 cells, straight at the foot-cell but slightly constricted at the base, with a basal septum at the branching point; conidia oval, 22-28 x 11-14 μm, producing germ tube on the shoulder with multilobed appressorium.

Specimens examined: HMAS 36459 (on *Fraxinus bungeana* DC.); SMK 10005, 10282, 11063, 11818, 12857, 13049, 13055, 13103 (all on *Fraxinus rhynchophylla* Hance)

Notes: Shin (1988) described the anamorphic characteristics of this species. The present observations agree well with his descriptions and measurements. In the present work, additional information of taxonomic value on mycelial feature and conidiophore position is given.

17. *Uncinula sapindi* S. R. Yu — Fig. 17

Amphigenous, thinly effuse to forming thin patches; mycelial cells 35-50 x 4-5 μm, branching at right angles, with a septum at the branching point; appressoria multilobed, opposite or single; conidiophores single on a hyphal cell, 66-146 x ca 6 μm, arising from the upper part of the mother cell, position central to non-central(2:1), producing conidia singly, followed by 2-4 cells, straight at the foot-cell, with a basal septum at the branching point; conidia oval, 24-32 x 12-14 μm, producing germ tube on the shoulder.

Specimen examined: HMAS 62196 (type, on *Sapindus mukorossi* Gaertn.)

Notes: The anamorphic characteristics of the fungus were given in the original description as follows: 'conidiophores clavate, thin at the base, 60-100 μm long; conidia in chains, long ellipsoidal to ellipsoid, 13.3-16.5 x 26.6-36.6 μm' (Yu, 1993). The present observations agree well. This fungus is characterized by long, slender conidiophores with straight foot-cells. The cell(s) below the uppermost one on the conidiophore is/are not swollen but straight, thus differing from those of *Oidium* s. str. with conidia in chains.

18. *Uncinula toxicodendricola* Z. X. Chen & Yao Fig. 18

Amphigenous, but mostly epiphyllous, also cauligenous, thinly effuse, evanescent to subpersistent; mycelial cells 40-60 x 3-4(-5) μm, branching at right angles, with a septum at the branching point; appressoria moderately lobed to multilobed, usually single; conidiophores single on a hyphal cell, 40-50 x ca 5 μm, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position central, producing conidia singly, followed by 1(-2) cells, with a basal septum at the branching point; conidia oblong to cylindric, 25-32 x 9-12 μm, producing germ tube on the shoulder with multilobed appressorium.

Specimen examined: HMAS 58495 [isotype, on *Toxicodendron sylvestrae* (S. & Z.) O. Kuntze]

Notes: The anamorphic characteristics of the fungus have not been described by Chen & Yao (1991). This fungus is characterized by short, slender, 2-celled conidiophores with curved foot-cells.

19. *Uncinula verniciferae* P. Henn. Fig. 19

Amphigenous, usually subpersistent on the upper surface but evanescent on the lower surface of leaves; mycelial cells 45-75 x 3-5 μm, branching at right angles, with a septum at 0-15 μm above the branching point; appressoria multilobed to moderately lobed, single or opposite; conidiophores single on a hyphal cell, 55-80(-112) x 6-8 μm, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position central to non-central(2:1), producing conidia singly, followed by 2(-3) cells, with a basal septum at the branching point; conidia oblong to cylindric oval, 26-29 x 9-10 μm, containing oil drops, producing germ tube on the shoulder or below the shoulder with multilobed appressorium.

Specimens examined: HMAS 38788 (on *Cortinus* sp.); SMK 10041, 10089, 10468, 10642, 12987 (all on *Cotinus coggygria* Scop.), 11044, 11171, 11186, 11226, 11240, 11297, 11327, 11396, 12026, 12237, 12957, 12966 (all on *Rhus chinensis* Mill.), 10068 (on *Rhus verniciflua* Stokes)

Notes: Shin (1989) described the anamorphic characteristics of this fungus in detail. The present observations agree well with his description. Nomura (1992) described and illustrated conidiophores arising from the upper part or the side of the mother cell. In the material examined here, however, all conidiophores are produced from the side of the mother cells and with curved (L-shaped) foot-cells. In present work, additional information on mycelial morphology and conidiophore position on the mother cell are given.

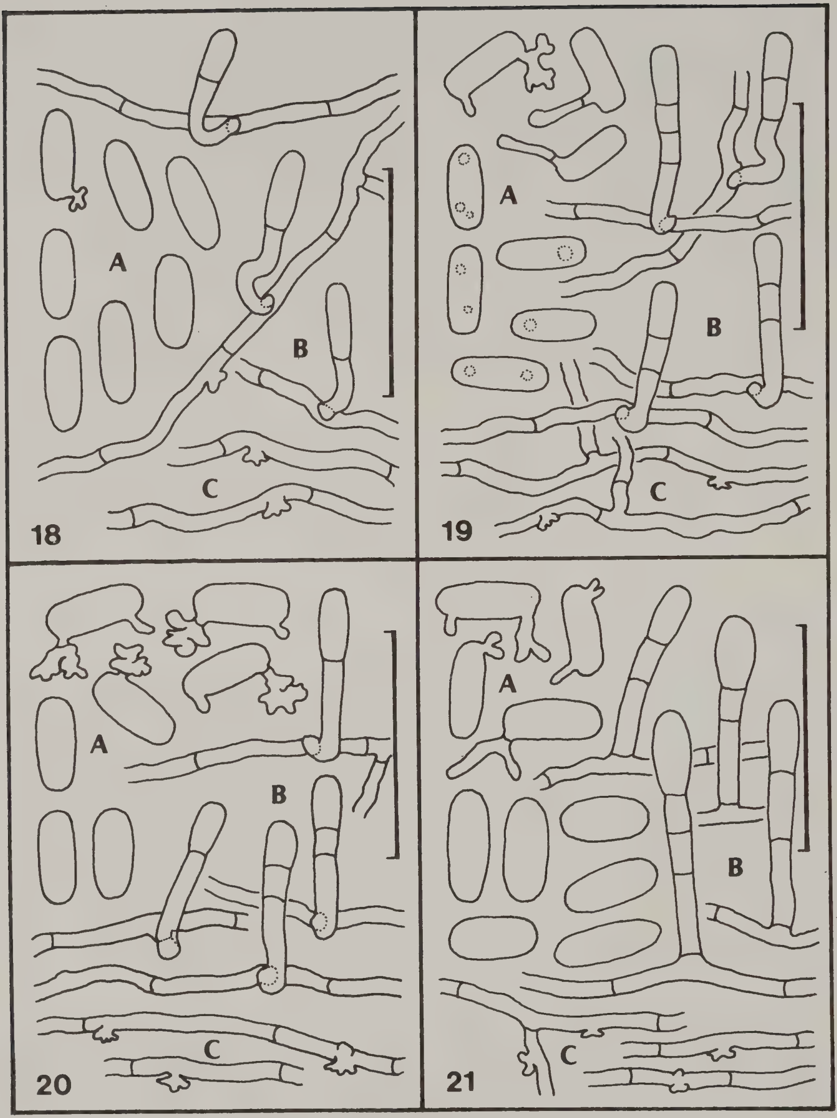


Fig. 18. *Uncinula toxicodendricola* Z. X. Chen & Yao
Fig. 19. *Uncinula verniciferae* P. Henn.
Fig. 20. *Uncinula yaanensis* Tao & Li
Fig. 21. *Uncinuliella australiana* (McAlp.) Zheng & Chen
A. Conidia with or without germ tubes;
B. Conidiophores; **C**. Mycelium with or without appressoria. H. D. Shin del. (Bar = 50 μm)

20. *Uncinula yaanensis* Tao & Li Fig. 20

Epiphyllous, persistent, effuse to forming irregular patches; mycelial cells 40-70 x 4-5 μm, branching at right angles, usually with a septum at the branching point; appressoria multilobed to moderately lobed, opposite or single; conidiophores single on a hyphal cell, 52-60 x 6-7 μm, usually slightly broader upwards, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position central or slightly non-central, producing conidia singly, followed by 1-2 cells, with a basal septum at the branching point; conidia oblong to cylindric oval, 27-32 x 11-14 μm, producing germ tube(s) on the shoulder with multilobed appressorium.

Specimen examined: HMAS 36494 [on *Cudrania tricuspidata* (Carr.) Bur.]

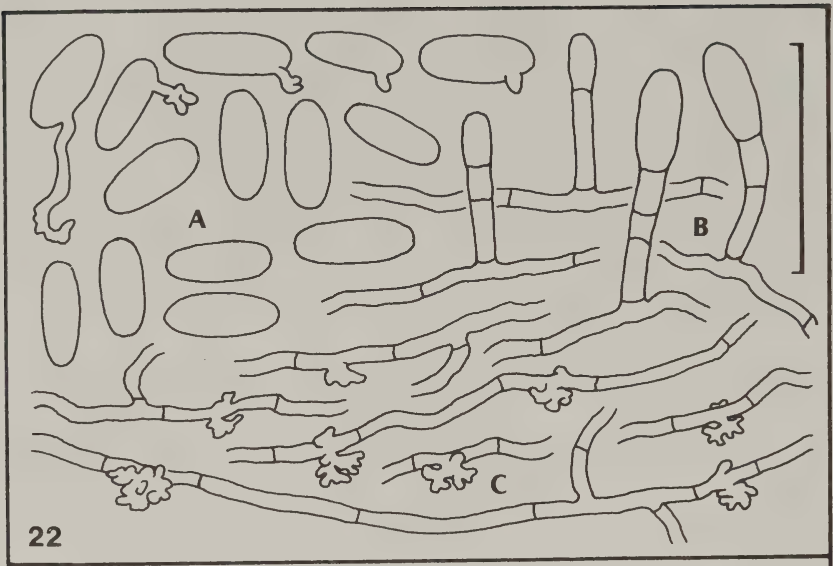
Notes: The anamorphic characteristics have not been reported by Tao *et al.* (1977). This is the first description of the imperfect state for this species.

21. *Uncinuliella australiana* (McAlp.) Zheng & Chen Fig. 21

Amphigenous, also cauligenous and floricolous, effuse to forming white patches, at last covering the entire surfaces of the young shoots and inflorescences, white, with age turning to ochre or grayish; mycelial cells 40-70 x 3-4(-5) μm, branching at right angles, with a septum at the branching point; appressoria moderately lobed to multilobed, usually single, sometimes opposite; conidiophores single on a hyphal cell, 42-68 x 5-6 μm, sometimes broader upwards, arising from the upper part of the mother cell, position central, producing conidia singly, followed by (1-)2-3 cells, straight at the foot-cell, sometimes slightly constricted at the branching point, with a basal septum at the branching point; conidia oval, 24-36 x 12-14(-16) μm, producing germ tube(s) on the shoulder, germ tubes usually biforked, sometimes straight or multilobed.

Specimens examined: HMAS 40303, 40304; SMK 10819, 10891, 10896, 11261, 12075, 12982, 12223, 12639 (all on *Lagerstromia indica* L.)

Notes: Several workers have already described the anamorphic characteristics of this species in detail (Boesewinkel, 1979; Shin, 1988; Nomura, 1992). The present observations agree well with these previous records. The characteristic of producing biforked germ tubes on conidia, which is reported here for the first time, distinguishes this fungus from all the other known related species.



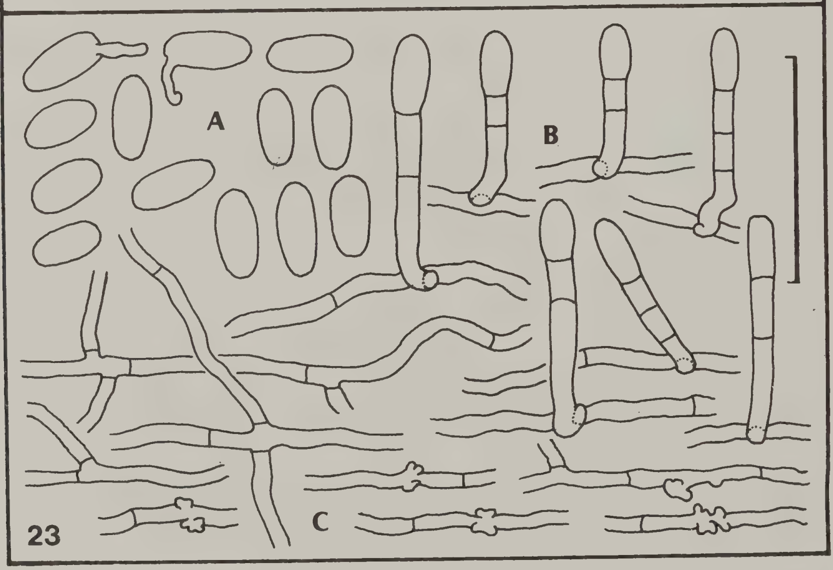


Fig. 22. *Uncinuliella liquidambaris* (Zheng & Chen) Zheng, Chen & Z. X. Chen

Fig. 23. *Uncinuliella pistaciae* Lu & K. R. Wang

A. Conidia with or without germ tubes; **B**. Conidiophores; **C**. Mycelium with or without appressoria. H. D. Shin del. (Bar = 50 μm)

22. *Uncinuliella liquidambaris* (Zheng & Chen) Zheng, Chen & Z. X. Chen Fig. 22

Amphigenous, subpersistent, effuse to forming white patches; mycelial cells 36-60(-84) x 3-5 μm, but being 16-34(-44) μm long when having appressoria, branching at right angles, usually with a septum at the branching point; appressoria coral-shaped to multilobed, opposite or single; conidiophores single on a hyphal cell, 46-64 x 6-8 μm, arising from the upper part of the mother cell, position central to slightly non-central, producing conidia singly, followed by 2(-3) cells, straight at the foot-cell, with a basal septum at the branching point; conidia cylindric oval to oblong, 30-39 x 10-14 μm, producing germ tubes below the shoulder with multilobed appressorium.

Specimen examined: HMAS 62190 (on *Liquidambar formosana* Hance)

Notes: The anamorphic characteristics have not been reported by Zheng & Chen (1985) in the original description. This fungus is characterized by coral-shaped appressoria which are known in a limited species of powdery mildews only. The position of germ tubes on the conidia is also a good taxonomic character, since only few species of powdery mildews are known to produce their germ tubes below the shoulders of the conidia.

In addition, we have examined the anamorphic features of *Uncinuliella praelonga* S. R. Yu (type material, HMAS 62197, on *Liquidambar formosana*). The anamorph of this fungus is in accordance with that of *Ul. liquidambaris* regarding conidial size, morphology of appressoria, position of germ tubes, and other characteristics of taxonomic value. Furthermore, the teleomorphic characteristics of *Ul. praelonga* are also quite similar to those of *Ul. liquidambaris* according to Zheng & Chen (1985) and Yu (1993). Perhaps, it is better to treat *Ul. praelonga* as a variety of *Ul. liquidambaris*.

23. *Uncinuliella pistaciae* Lu & K. R. Wang Fig. 23

Amphigenous, persistent, effuse; mycelial cells 40-60 x 3-5 μm, branching at right angles, with a septum at the branching point; appressoria multilobed to moderately lobed, opposite or single; conidiophores single on a hyphal cell, 46-70 x 6-7 μm, arising from the side of the mother cell, thus curved (L-shaped) at the base of the foot-cell, position central to non-central(2:1), producing conidia singly, followed by 2(-3) cells, with a basal septum at the branching point; conidia oval, 22-32 x 10-13 μm, producing germ tube on the shoulder.

Specimens examined: HMAS 50138 (isotype), 62189 (both on *Pistacia chinensis* Bunge)

Notes: In the original description of the holomorph of this fungus, Lu & Wang (1987) described 'oblong conidia, 28.6-33.8 x 10.4-12.4 μm' and published a drawing of a conidiophore. Additional information to the imperfect state of this fungus is provided in the present study.

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MYCOTAXON

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NEW AND INTERESTING AERO-AQUATIC MITOSPORIC FUNGI FROM ITALY

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ABSTRACT

Spirosphaera lignicola sp. nov., an aero-aquatic mitosporic fungus found on a submerged unidentified decaying twig in a stream in woodland in Italy, is described and illustrated. It is characterized by developing more than one lateral branch on the parent filament, coiling and intertwining in different planes, then branching again in the same way, resulting in a tightly interwoven globose conidial propagule and also by its conidial filament which is knobbly. Two additional aero-aquatic species ***Candelabrum brocchiatum*** and ***Helicodendron luteo-album*** are reported for the first time in Italy.

Key words: ***Spirosphaera***, ***Candelabrum***, ***Helicodendron***, aero-aquatic fungi, mitosporic fungi, Italy.

RESUMEN

Se describe e ilustra ***Spirosphaera lignicola*** sp. nov., hongo mitospórico aeroacuático aislado de una rama no identificada en descomposición hallada en un riachuelo de un bosque en Italia. Dicho hongo se caracteriza por poseer varias ramas laterales que se desarrollan a partir de un filamento primario. Estas ramas se enrollan y entrecruzan en diferentes planos, con ramificaciones sucesivas y formando en conjunto un propágulo conidial globoso compuesto por un entramado denso de filamentos nudosos. Se citan por primera vez para Italia las especies ***Candelabrum brocchiatum*** y ***Helicodendron luteo-album***.

Palabras clave: ***Spirosphaera***, ***Candelabrum***, ***Helicodendron***, hongos aeroacuáticos, hongos mitospóricos, Italia.

INTRODUCTION

Three aero-aquatic mitosporic fungi were isolated and grown in pure culture from submerged decaying plant materials collected from a stream in woodland in Italy. They include a new species, ***Spirosphaera lignicola***, and two new records for the Italian mycobiota, ***Candelabrum brocchiatum*** Tubaki and ***Helicodendron luteoalbum*** Glen-Bott. The reported species are described and illustrated by scanning electron microscopy.

DESCRIPTION AND DISCUSSION

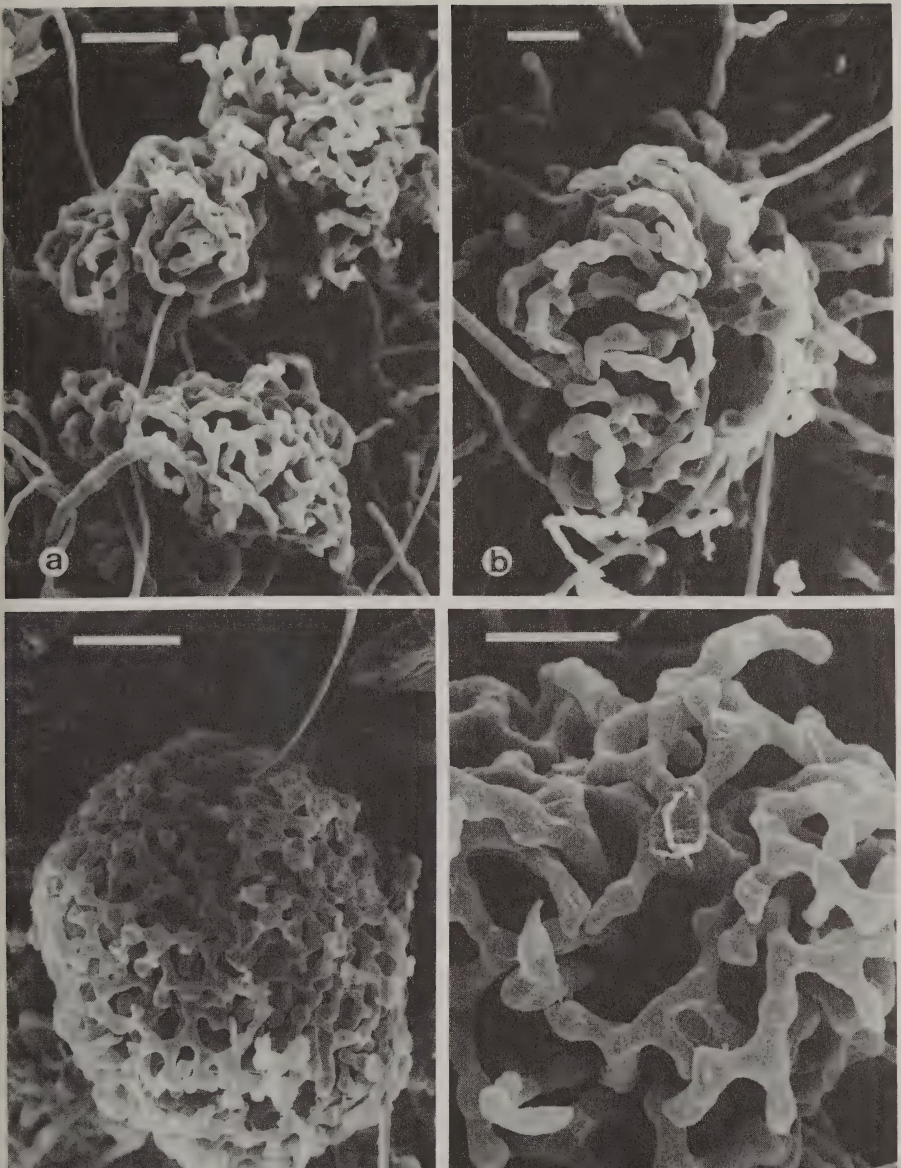
Spirosphaera lignicola Abdullah, Gené *et* Guarro, *sp. nov.* Fig. 1

Coloniae in substrato naturali atrovirides; in agaro maltoso 0.2 % ad 15°C 2 cm diam. post 14 dies. Mycelium plerumque immersum, ex hyphis luteobrunneis, septatis, 2-2.5 µm latis, compositum. Conidiophora mononematosa, macronematosa, simplicia, septata, brevia, 3-4 µm lata. Cellulae conidiogenae blasticae, integratae. Conidia gregaria aut disseminata, olivacea vel atroviridia, glomerulosa, 60-130 µm diam., ex intricatis spiris composita, unaquaeque spira ramos generat, qui diverso crescunt et novas spiras formant, intricantur et iterum ramos generant usque adeo ut rarus filamentorum globus formetur. Filamenta laevia, septata, in septis constricta, nodulosa, cum cellulis 3-5 µm latis, 4-6 longis.

Aero-aquatic fungus. Colony on natural substrate dark green; on 0.2% MEA reaching a diam. of 2 cm in two weeks at 15°C; colony reverse dark green. Mycelium mostly immersed, slightly raised at the centre, composed of yellowish brown, septate hyphae, 2-2.5 µm wide. Conidiophores mononematous, macronematous, simple, septate, 3-4 µm wide, very short, arising from the immersed mycelium. Conidiogenous cells blastic, integrated. Conidial propagules gregarious or scattered, olive green to dark green, forming a globose ball of threads, 60-130 µm diam., consisting of interwoven spirals, each spiral giving rise to more than one branch in different directions to form new spirals, coiling and intertwining, then branching again in the same way resulting in a tightly interwoven globule. Filaments smooth, septate, constricted at septa, knobbly, with cells 3-5 µm wide and 4-6 µm long.

Holotype: IMI 375019, on a submerged unidentified twig in a stream, Monticiano, Siena province, Italy, 5 Nov. 1996, coll. S.K. Abdullah. *Isotype:* FMR 5943.

Fig. 1. ***Spirosphaera lignicola*** (IMI 375019). **a, b, d.** Knobbly conidial filaments; **c.** Conidial propagule on natural substrate. Scale bars: a, c = 20 µm; b, d = 10 µm.


a
b
c
d

The genus ***Spirosphaera*** was introduced by Van Beverwijk (1953) based on ***S. floriformis*** Beverw. The type was found growing on decaying ***Betula*** leaves under the water surface of a pond in the Netherlands. ***Spirosphaera*** is characterized by forming conidial propagules consisting of interwoven filaments, each filament developed as a lateral branch on the parent filament, coiling and interwining and producing new coiling branches in the same way to form globose to subglobose or loose balls of irregular shapes. Hennebert (1968) described two new species, ***S. beverwijkiana*** and ***S. minuta***. Abdullah et al. (1986) described one further species, ***S. verruculosa***. All species of ***Spirosphaera*** are known from aquatic habitats colonizing a variety of decaying plant materials which have fallen in small stagnant, ponds or in small rivers and streams with slow running water in woodlands. The characteristic feature of the new species is the development of more than one lateral branch on the parent filament, coiling and intertwining in different directions then branching again in the same way, resulting in a tightly interwoven conidial propagule. Moreover, the conidial filament of the new species is knobbly especially at the periphery, a character which shared only with ***S. minuta***. However, the latter species is clearly differentiated as it has the narrowest conidial filament (1.5-2 μm) among species of the genus.

Candelabrum brocchiatum Tubaki, Trans. Mycol. Soc. Japan 16: 134 (1975).
Fig. 2 a-c

Aero-aquatic fungus. Colony on natural substrate white to pale cream; on 0.2% MEA reaching a diam. of 5 mm in two weeks at 15ºC; colony reverse yellowish white. Mycelium immersed, hyaline, septate, branched, 1.5-2.0 μm wide. Conidiophores mononematous, macronematous, straight, smooth, unbranched, hyaline, up to 40 μm long and 2-2.5 μm wide. Conidiogenous cells monoblastic, determinate. Conidial propagule white to pale cream, spherical, 80-130 μm diam., developed from four central basal cells forming a X-shaped body. Each basal cell branches dichotomously several times in all directions; branches short, mostly containing one cell 4-5 μm long and 3-4 μm wide. Terminal cells inflated, ending with 2-4 very short branches, each branch is ornamented with minute tubercles.

Specimen examined: FMR 5947, on unidentified submerged decaying wood in a stream, Monticiano, Siena province, Italy, 5 Nov. 1996, coll. S.K. Abdullah.

Candelabrum brocchiatum has so far only been found colonizing submerged decaying wood but not leaves (Tubaki, 1975; Abdullah & Fisher, 1984). Our finding represent the first report for the species from Italy.

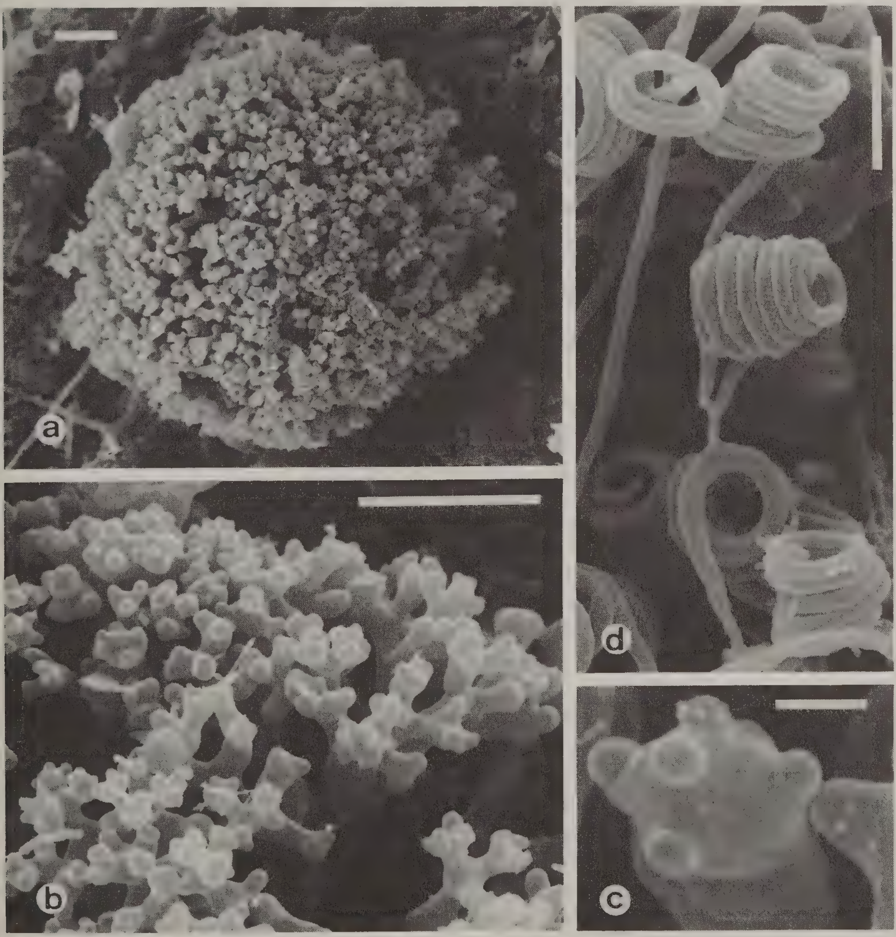
Fig. 2. a-c. ***Candelabrum brocchiatum*** (FMR 5947); **d.** ***Helicodendron luteo-album*** (FMR 5946). **a.** Conidial propagule; **b.** Terminal cells; **c.** Terminal cells ornamented with minute tubercles; **d.** Conidia. Scale bars: a, b, d = 10 μm; c = 1 μm.

Helicodendron luteo-album Glen-Bott, Trans. Brit. Mycol. Soc. 38: 24 (1955).

Fig. 2 d

Aero-aquatic fungus. Colonies on 0.2% MEA reaching a diam. of 1.5 cm in 2 weeks at 15ºC; colony reverse white to pale yellow. Mycelium mostly immersed, hyaline, septate, branched, 2-2.5 μm wide. Conidiophores mononematous, micronematous, branched, 200-800 x 2-2.5 μm. Conidiogenous cells blastic, integrated, terminal or intercalary. Conidia acropleurogenous, hyaline, consisting of a filament of 1.5-3 μm wide, tightly coiled 4-6 (-10) times in a counter-clockwise direction to form a three dimensional helix measuring 15-28 x 12-15 μm.

Specimen examined: FMR 5946, from submerged decaying leaves of ***Quercus*** sp. in a stream, Monticiano, Siena province, Italy, 5 Nov. 1996, coll. S.K. Abdullah.



The fungus can be easily distinguished by the white colour of its conidia, white to pale yellow colony reverse on 0.2% MEA and the counter-clockwise direction of its conidial filament. The species is so far known only from Great Britain (Glen-Bott, 1955; Abdullah & Fisher, 1984) and from Quebec, Canada (Anonymous, 1994).

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A CHECK-LIST OF THE GREEK MACROFUNGI INCLUDING HOSTS AND BIOGEOGRAPHIC DISTRIBUTION: I. BASIDIOMYCOTINA

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Abstract: As a preliminary step towards a more intensive research on the diversity of macromycetes in Greece, an updated check-list of the Greek mycoflora is presented together with information on the host-substrates and geographic occurrence. The data originated from a thorough literature search and the authors' field observations. In total, 58 families, 214 genera and 811 species of fungi are recorded belonging to Basidiomycetes. The systematics and nomenclature of the relative bibliography have been updated and suitably revised. The large gaps in our knowledge on the existence and distribution of higher fungi in Greece are emphasized.

Key-Words: biodiversity, biogeography, Greece, higher fungi, macromycete, Mediterranean, mushroom, mycoflora, nomenclature, systematics

The mycoflora of Greece is still very poorly known and is believed that only a small part of the existing fungal biodiversity has been discovered, which amounts to about 2500 species. Indicative is the fact that in countries of equivalent or even smaller size (e.g. United Kingdom or Switzerland) many more fungal species have been described so far (12000 and 10000 respectively) (Hawksworth 1991). In addition, the diversity of landscapes, the multitude of substrates and the particular biogeographic position of the country as well as the large number of species of vascular plants recorded up till now (circa 4900 of which over 700 are endemic, Greece heads the respective list in Europe) create a great variety of habitat conditions. It also reveals the research potential and the necessity to work more intensively in this specific area, as with the notable exceptions of the fungus-host index of Greece (Pantidou 1973) and a series of papers by Diamandis (mainly on the mycoflora of the northern regions) very few data are available.

The present work includes innformation available through extensive literature search and the authors' field observations until the summer of 1996, when a more detailed fungal biodiversity study was undertaken by them. The total number of species of the subdivision Basidiomycotina (mainly Homobasidiomycetes) reported in this list is 811, assigned in 214 genera, and 58 families. Fungi are presented in alphabetical order, e.g. species within each genus as well as genera within families and orders, etc.

Classification of genera in orders and families as well as nomenclature follows the guidelines of the latest edition of the Dictionary of Fungi (Hawksworth et al. 1995).

In addition keys and field books on European fungal species were used (Moser 1983, Ryvarden & Gilbertson 1993, Breitenbach & Kränzlin 1987, etc.) Authors citations following the latin names of fungi were updated too from previous citations in literature and an effort was made to be as close to the rules of the International Code of Botanical Nomeclature as possible. Species synonyms are provided only when the current name of the fungus differs from the one originally reported in literature (the latter is quoted in brackets).

Under each fungal species data on biogeography and hosts/substrates are given in chronological order based on relative literature, last being (where available) the authors' field findings. In the cases where more than one publication of the same author refers to the same observations, only the first one is quoted hereby. Hosts include the genera and species of plants cultivated or wild, alive or dead on which macrofungi were found. Their latin names are quoted exactly as they appear in the literature. The geographical distribution data present the collection site (mountain, village/town, island, etc.) followed by the name of the corresponding administrative prefecture ("nomos" in Greek) in parenteses.

Abbreviations used: Mt., mountain; NPR, National Park Reserve; PF, Protected Forest.

BASIDIOMYCOTINA

Homobasidiomycetes

Agaricales

Agaricaceae:

Agaricus abruptibulbus Peck

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Agaricus arvensis Schaeff.

(Landarer 1858); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); in fields (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)

Agaricus augustus Fr.

in *Quercus pubescens* (Diamandis & Perlerou 1990)

Agaricus bernardii (Quél.) Sacc.

(Maire & Politis 1940); in dunes (Diamandis & Perlerou 1990); (Diamandis 1992)

Agaricus campestris L.: Fr.

(Landarer 1858); (Maire & Politis 1940); NPR of Mt. Olympos, NPR of Pindos, PF of Fracto (Drama) (Avtzis & Diamandis 1988); Vassilika (Thessaloniki) (Minter 1988); Dervenohoria (Attiki), Drosopigi (Florina), Katafygi (Pieria), Damaskinia (Kozani), Petrota (Evros), Lesvos (Keltemlidis 1990); in fields rich in manure (Pantidou 1990); Mt. Oxia (Fthiotida) in fields (this work)

Agaricus haemorrhoidarius Kalchbr. & Schulzer

Sami (Kefallonia) in *Quercus* sp. and *Arbutus unedo* (Pantidou 1973)

Agaricus luteo-maculatus (Moell.) Moell.

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Agaricus nivescens (Moell.) Moell.

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Agaricus placomyces Peck.

(Diamandis 1985)

Agaricus silvaticus Schaeff.

(Landarer 1858); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); in *Abies borisii-regis* (Diamandis 1985); Trifillia (Messinia) (Keltemlidis 1990)

Agaricus silvicola (Vitt.) Peck

(Maire & Politis 1940); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Ayia Trias (Attiki) in *Pinus halepensis* (Pantidou et al. 1983); (Keltemlidis 1990); Attiki (Pantidou 1990); (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)

Agaricus subfloccosus (Lange) Pilát

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Agaricus xanthodermus Genevier

in *Castanea sativa* (Maire & Politis 1940); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); NPR of Mt. Olympos (Avtzis & Diamandis 1988); (Keltemlidis 1990); in *Quercus ilex* and *Arbutus unedo* (Diamandis 1992)

Cystoderma amianthinum [(Scop.) Fr.] Fayod

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1990); in *Abies cephalonica* and *A. borisii-regis*, and *Pinus nigra* (Diamandis 1992), Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)

Cystoderma carcharias (Pers.) Fayod

Mt. Parnitha (Attiki), Ainos (Kefallonia), Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Abies cephalonica* (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Cystoderma cinnabarinum (Secr.) Fayod

Mt. Parnitha (Attiki) in *Pinus halepensis* and *Abies cephalonica* (Pantidou et al. 1983); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Cystoderma fallax Smith & Singer

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Cystoderma granulosum (Fr.) Fayod

Mt. Parnitha (Attiki), Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Tatoi (Attiki) in mixed conifers (Pantidou et al. 1983); Attiki in *Pinus* sp. (Pantidou 1990); in *Abies cephalonica* and *A. borisii-regis*, and *Pinus nigra* (Diamandis 1992); in *Pinus nigra* (Diamandis & Perlerou 1994); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Cystoderma terrei (Berk. & Br.) Harmaja

Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Cystolepiota adulterina (Moell.) Bonn.

in *Quercus pubescens* forests (Diamandis 1992)

Cystolepiota sistrata (Fr.) Sing.: Bon. & Bellu {= *Lepiota sistrata* (Fr.) Quél.}

NPR of Mt. Olympos in *Fagus sylvatica*. (Diamandis & Perlerou 1990)

Lepiota acutesquamosa (Weinm.) Kummer
in *Abies* sp. and *Pinus* sp. (Maire & Politis 1940); in *Fagus sylvatica* (Diamandis & Perlerou 1994)
Lepiota barlaeana Pat.
in *Pinus halepensis* (Maire & Politis 1940)
Lepiota castanea Quél.
in *Cupressus* sp. (Diamandis 1983)
Lepiota cepaestipes (Sow.: Fr.) Quél.
(Maire & Politis 1940)
Lepiota clypeolaria (Bull.: Fr.) Kummer
(Heufler 1868); (Maire & Politis 1940); Mt. Parnitha (Attiki), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); (Pantidou 1990); in *Cupressus glabra* plantations, in *Fagus orientalis*, *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)
Lepiota cristata (Fr.) Kummer
in *Abies* sp. and *Pinus halepensis* (Maire & Politis 1940); Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); in *Fagus orientalis*, *Abies cephalonica* and *Pinus halepensis* (Diamandis 1992)
Lepiota subalba Kühn.: Orton {= *Lepiota naucina* Fr.}
in *Pinus halepensis* (Maire & Politis 1940); in *Abies cephalonica* (Pantidou 1973)
Lepiota ventriosospora Reid
Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Leucoagaricus holosericeus (Fr.) Mos. {= *Lepiota holosericea* (Fr.) Gillet}
(Maire & Politis 1940)
Leucoagaricus leucothites (Vitt.) Wasser {= *Lepiota leucothites* (Vitt.) P. Orton}
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); Tsangaratha and Hania (Magnesia) in *Castana sativa* and *Fagus sylvatica* respectively (Pantidou & Gonou 1984); in *Pinus* sp. (Pantidou 1990)

Macrolepiota excoriata (Schaeff.: Fr.) Wasser {= *Lepiota excoriata* (Schaeff.: Fr.) Kummer}
in *Pinus nigra* (Maire & Politis 1940); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); in *Pinus nigra* and *P. brutia* (Diamandis 1992); Andros in *Olea oleracea*, and *Vitis vinifera* (Lizon, pers. comm.)
Macrolepiota mastoidea (Fr.) Sing. {= *Lepiota mastoidea* (Fr.) Kummer}
in *Castanea* sp. (Maire & Politis 1940); (Diamandis 1985); in *Castanea sativa* and *Fagus orientalis* (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)
Macrolepiota procera (Scop.: Fr.) Singer {= *Lepiota procera* (Scop.: Fr.) S.F. Gray}
in *Fagus sylvatica* (Diapoulis 1939), in *Pinus nigra* and *Quercus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Pinus halepensis* (Diamandis 1983); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); in *Castanea sativa* (Diamandis 1985); Kastri and Kosmas

(Arkadia), Kydonies (Grevena), Rethymno (Crete), Mantra (Evros), Samos (Keltemlidis 1990), Mt. Oxia (Fthiotida) in *Fagus sylvatica*, Mt. Pilion (Magnesia) in *Fagus sylvatica* and Gardiki (Fthiotida) in *Quercus* sp. (this work)

Macrolepiota rhacodes (Vitt.) Sing.

in *Fagus* sp. (Maire & Politis 1940); on sheep manure (Diamandis 1992), NPR of Mt. Olympos (Diamandis & Perlerou 1994); Andros in *Cistus* sp., and in *Cupressus sempervirens* (Lizon, pers. comm.); Mt. Oxia (Fthiotida) in *Fagus sylvatica*, Mt. Pilion (Magnesia) in *Fagus sylvatica* and Gardiki (Fthiotida) in *Quercus* sp. (this work)

Amanitaceae:

Amanita caesaria (Fr.) Schw.

in *Castanea* sp., *Quercus* sp. and *Pinus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Pilion (Magnesia), Agion Oros (Halkidiki), Samos, Xanthi (Keltemlidis 1990); Thessalia and Lakonia in *Pinus* sp., *Quercus* sp. and *Castanea sativa* (Pantidou 1990); Mt. Holomontas (Halkidiki) in *Quercus conferta*, *Q. pubescens*, *Castanea sativa* and *Abies cephalonica* (Diamandis 1992)

Amanita citrina (Schaeff.) S.F. Gray

in *Quercus* sp. (Heufler 1868); in *Fagus* sp. and *Quercus* sp. (Diapoulis 1939); in *Fagus* sp. (Maire & Politis 1940); in *Abies borisii-regis* (Diamandis 1985); in *Pinus sylvestris*, *Fagus orientalis*, *Quercus conferta* and *Castanea sativa* (Diamandis 1992)

Amanita crocea (Quél.) Sing.

Andros in *Quercus* sp., and *Q. ilex* (Lizon, pers. comm.)

Amanita echinocephala (Vitt.) Quél.

in *Quercus pubescens* (Diamandis & Perlerou 1990)

Amanita eliae Quél.

Kakoskali (Mt. Ossa) in *Fagus sylvatica* (Pantidou & Gonou 1984)

Amanita muscaria (L.: Fr.) Hook

in *Fagus sylvatica* (Diapoulis 1939); in *Pinus nigra* (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); PF of Fracto (Drama) in *Picea abies* (Avtzis & Diamandis 1988); Pieria (Keltemlidis 1990); Mt. Taygetos (Peloponnese) in *Pinus* sp. (Pantidou 1990); in *Abies borisii-regis* (Diamandis & Perlerou 1990); in *Abies cephalonica*, *Quercus conferta* and *Castanea sativa* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* and Mt. Pilion (Magnesia) in *Castanea sativa* (this work)

Amanita ovoidea (Fr.) Quél.

Attiki in *Abies cephalonica* and *Pinus halepensis* (Pantidou 1973); Mt. Parnitha (Attiki) in mixed conifers, and in *Pinus halepensis* (Pantidou et al. 1983); in *Juniperus recurva* plantations (Diamandis 1992)

Amanita pantherina (DC: Fr.) Krombh.

in *Fagus sylvatica* and *Quercus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou et al. 1983); Portaria (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); Pieria (Keltemlidis 1990); Attiki in *Pinus* sp.

(Pantidou 1990); in *Quercus conferta* and *Castanea sativa* (Diamandis 1992); Mt. Pilion (Magnesia) in *Castanea sativa* (this work)

Amanita phalloides (Vaill.: Fr.) Link

(Pantidou 1990); in *Quercus conferta* (Diamandis 1992); Andros in *Quercus* sp., and *Q. ilex* (Lizon, pers. comm.); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)

Amanita porphyria (Alb. & Schw.: Fr.) Secr.

Tsangaratha (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984)

Amanita rubescens [(Pers.) Fr.] S.F. Gray

in *Abies* sp, *Quercus* sp. and *Pinus* sp. (Maire & Politis 1940); Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); PF of Fracto (Drama) in *Picea abies* (Avtzis & Diamandis 1988); in *Quercus conferta* and *Fagus sylvatica* (Diamandis 1992); Andros in *Quercus coccifera*, and *Q. ilex* (Lizon, pers. comm.)

Amanita solitaria (Bull.: Fr.) Secr.

in *Quercus aegilops* and *Q. ilex* (Diamandis & Perlerou 1990)

Amanita vaginata (Bull.: Fr.) Vitt. {= *Amanitopsis vaginata* (Bull.: Fr.) Roze}

in *Quercus* sp., *Fagus* sp. and *Castanea* sp. (Maire & Politis 1940); in *Populus* sp. (Diamandis 1985); in *Quercus conferta* and *Fagus orientalis* (Diamandis 1992), NPR of Mt. Olympos in *Fagus sylvatica* (Diamandis & Perlerou 1990); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica*, and mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)

Amanita virosa (Fr.) Bertillon

in *Abies cephalonica* (Pantidou 1973); in *Pinus* sp. (Diamandis 1983); Mt. Parnitha (Attiki) in *Abies* sp. (Pantidou 1990)

Limacella illinita (Fr.) Murr.

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1990)

Bolbitiaceae:

Agrocybe aegerita (Brig.) Sing. {= *Pholiota cylindracea* (DC.: Fr.) Maire}

on *Populus nigra* and *Ricinus* sp. (Maire & Politis 1940); on *Populus* sp. (Pantidou 1973); on *Platanus orientalis* (Diamandis & Perlerou 1990); on *Platanus orientalis* (Diamandis 1992); Andros on *Populus alba* (Lizon, pers. comm.); Ypati and Molos (Fthiotida) on *Populus* sp. (this work)

Agrocybe molesta (Lasch) Sing. {= *Agrocybe dura* (Bolt.: Fr.) Sing.}

in *Populus* sp. plantations (Diamandis 1992)

Agrocybe praecox (Pers.: Fr.) Fayod

Marathonas (Attiki) in fields (Pantidou 1990)

Agrocybe semiorbicularis (Bull.: Fr.) Fay.

(Maire & Politis 1940); Iberon Monastery, and Pantokratoros Monastery (Agion Oros) (Minter 1988)

Agrocybe vervacti (Fr.) Maire

(Maire & Politis 1940)

Bolbitius vitellinus (Pers.: Fr.) Fr.

(Maire & Politis 1940); (Diamandis 1992)

Conocybe lactea (Lange) Metrod.

NPR of Samaria (Crete) in *Pinus brutia* (Diamandis & Perlerou 1990)
Conocybe pseudopilosella (Kühn.) Kühn. & Romagn.
NPR of Pindos in *Pinus nigra* (Avtzis & Diamandis 1988); in *Pinus sylvestris* (Diamandis 1992); NPR of Mt. Olympos in *Pinus nigra* (Diamandis & Perlerou 1990)
Conocybe tenera (Schaeff.: Fr.) Kühn.
(Maire & Politis 1940)

Coprinaceae:
Coprinus atramentarius (Bull.: Fr.) Fr.
(Maire & Politis 1940); (Pantidou 1990); in *Fagus orientalis* (Diamandis 1992)
Coprinus cinereus (Schaeff.: Fr.) S.F. Gray
(Maire & Politis 1940)
Coprinus comatus (Müll.: Fr.) S.F. Gray
in *Abies* sp. (Maire & Politis 1940); in *Abies cephalonica* (Pantidou 1973); Mt. Parnitha (Attiki) in fields (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Dionysos (Attiki) in field (Pantidou et al. 1983); NPR of Mt. Olympos in fields and NPR of Pindos in *Fagus sylvatica* (Avtzis & Diamandis 1988); (Keltemlidis 1990); (Pantidou 1990); in fields (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* , Mt. Oiti (Fthiotida) in *Abies* sp., Mt. Pilion (Magnesia) in *Fagus sylvatica*, and Gardiki (Fthiotida) in *Abies* sp. (this work)
Coprinus congregatus Bull.: Fr.
(Diamandis 1985); (Diamandis 1992)
Coprinus disseminatus (Pers.: Fr.) S.F. Gray
on *Quercus conferta* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica*, and Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Coprinus domesticus (Bolt.:Fr.) S.F. Gray
Attiki (Pantidou 1990)
Coprinus fimatarius Fr.
(Heufler 1868)
Coprinus fuscescens Fr.
(Petrak 1943)
Coprinus hendersonii Fr.
on horse dung (Maire & Politis 1940)
Coprinus hiascens (Fr.) Quél.
(Maire & Politis 1940)
Coprinus impatiens (Fr.) Quél.
in *Fagus* sp. and *Populus* sp. (Diamandis & Perlerou 1990)
Coprinus lagopus (Fr.) Fr.
(Diamandis 1983); in *Castanea sativa* (Diamandis 1992), Kathenoi (Evoia) on cotton plant residues (this work)
Coprinus leiocephalus P. Orton
in *Alnus glutinosa* (Diamandis 1992)
Coprinus micaceus (Bull.: Fr.) Fr.
in *Fagus* sp. (Maire & Politis 1940); in *Pinus* sp. (Pantidou 1973); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); (Diamandis 1985); NPR of Mt. Olympos in *Fagus sylvatica* (Avtzis & Diamandis 1988); Dion (Pella) (Minter 1988); (Pantidou

1990); in *Castanea sativa* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* and Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Coprinus niveus (Pers.: Fr.) Fr.
on horse manure (Diamandis 1992); NPR of Mt. Olympos on cow manure (Diamandis & Perlerou 1990); Kathenoi (Evoia) on cotton plant residues (this work)
Coprinus ovatus Fr.
(Petrak 1943)
Coprinus picaceus (Bull.: Fr.) S.F. Gray
in *Castanea* sp. (Maire & Politis 1940); (Diamandis 1983); in *Quercus conferta* (Diamandis & Perlerou 1990); in *Fagus* sp.(Diamandis 1992); Gardiki (Fthiotida) in *Quercus* sp. (this work)
Coprinus plicatilis (Curt.: Fr.) Fr.
(Maire & Politis 1940); in fields (Diamandis 1992)
Coprinus radians (Desm.) Fr.
(Diamandis & Perlerou 1990); (Diamandis 1992)
Coprinus silvaticus Peck
(Pantidou 1990)
Coprinus varians
NPR of Mt. Olympos in *Fagus sylvatica* (Avtzis & Diamandis 1988)
Coprinus velox God.: Lange
on horse manure (Diamandis 1992)

Lacrymaria velutina (Pers.: Fr.) Konr. & Maubl.
(Diamandis 1985); in *Castanea sativa* and in mixed forests of *Picea abies*, *Pinus sylvestris* and *Fagus* sp. (Diamandis 1992)

Psathyrella candolleana (Fr.) Maire
Stavronikita Monastery (Agion Oros), Mt. Olympos (Minter 1988); (Diamandis 1992), Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Psathyrella conopilea (Fr.) Pears. & Dennis
(Diamandis 1985)
Psathhyrella gracilis (Fr.) Quél.
(Diamandis 1985)
Psathyrella hydrophila (Bull.) Maire
in *Quercus* sp. forests (Maire & Politis 1940); in *Fagus* sp. and *Quercus conferta* (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Psathyrella laevissima (Bull.: Fr.) Fr.
Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984)
Psathyrella marcescibilis (Britz.) Sing.
(Diamandis 1992)
Psathyrella microrhiza (Lasch.) Sing.
(Diamandis & Perlerou 1990)
Psathyrella multipedata (Peck) A.H. Smith
in *Castanea sativa* (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Psathyrella prona (Fr.) Gillet
in *Quercus conferta* (Diamandis 1992)

Psathyrella spintrigera (Fr.) Konr. & Maubl.
on *Quercus ilex* and *Castanea sativa* (Diamandis 1992)
Psathyrella squamosa (Karst.) Mos.
in *Fagus sylvatica* and *F. orientalis* (Diamandis 1992)
Psathyrella subatrata (Batsch.: Fr.) Gill.
in *Pinus halepensis* (Maire & Politis 1940)
Psathyrella tephrophylla Romagn.
Iberon Monastery, and Pantokratoros Monastery (Agion Oros) (Minter 1988)

Cortinariaceae:
Cortinarius alboviolaceus (Pers.: Fr.) Fr.
Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Cortinarius amoenolens R. Henry
in mixed forests of *Fagus sylvatica* and *Quercus conferta* (Diamandis 1992)
Cortinarius atrovirens Kalchbr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)
Cortinarius aurantioturbinatus (Secr.) Lange
Arkadia in *Abies* sp. (Pantidou 1990)
Cortinarius brunneofulvus Fr.
in *Fagus* sp. (Maire & Politis 1940)
Cortinarius brunneus Fr.
(Maire & Politis 1940)
Cortinarius caerulescens (Schaeff.: Secr.) Fr.
(Maire & Politis 1940)
Cortinarius caesiocyaneus Britzelm.
(Maire & Politis 1940)
Cortinarius cinnamomeobadius R. Henry
in *Pinus nigra* (Diamandis 1992)
Cortinarius cinnamomeus (L.: Fr.) Fr.
in *Quercus conferta* (Diamandis & Perlerou 1994)
Cortinarius collinitus Fr.
in *Quercus* sp. (Heufler 1868); in *Quercus* sp. (Maire & Politis 1940)
Cortinarius cotoneus Fr.
Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Cortinarius cyanites (Fr.) S.F. Gray
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)
Cortinarius decolorans Fr.
(Heufler 1868); (Maire & Politis 1940)
Cortinarius depressus Fr. ss Gillet
Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)
Cortinarius dibaphus Fr.
Mt. Parnitha (Attiki), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Cortinarius duracinus Fr.
in *Pinus nigra* (Maire & Politis 1940)

Cortinarius elatior Fr.
Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Cortinarius erythrinus (Fr.: Secr.) Fr.
(Maire & Politis 1940)
Cortinarius evernius Fr.
Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Cortinarius fulgens Fr.: All. & Schw.
in *Fagus* sp. (Diapoulis 1939)
Cortinarius glaucopus (Schaff.: Fr.) Fr.
Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); in *Abies borisii-regis* (Diamandis 1985); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Cortinarius infractus Fr.
(Maire & Politis 1940)
Cortinarius isabellinus (Batsch: Fr.) Fr.
in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)
Cortinarius lepidopus Cooke
in *Quercus conferta* (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Cortinarius malicorius Fr.
in *Pinus nigra* (Maire & Politis 1940)
Cortinarius melinus Britz.
in *Pinus brutia* (Diamandis 1992)
Cortinarius melliolens Schaeff.
NPR of Mt. Olympos in *Fagus* sp. (Diamandis & Perlerou 1994)
Cortinarius multiformis (Fr.) Fr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); in *Abies borisii-regis* (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Cortinarius obtusus Fr.
in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)
Cortinarius olidus Lange
(Diamandis 1985); in *Abies borisii-regis*(Diamandis & Perlerou 1994)
Cortinarius orichalceus (Batsch.: Secr.) Fr.
(Maire & Politis 1940)
Cortinarius phoeniceus (Bull.) Maire
in *Fagus sylvatica* (Diamandis 1983); in *Fagus orientalis* (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Cortinarius prasinus Fr. s.s. Konr. & Maubl.
Pertouli (Karditsa) in *Abies borisii-regis* (Diamandis & Perlerou 1990); in *Abies borisii-regis* (Diamandis & Perlerou 1994)
Cortinarius pseudosalor Lange
Mt. Pilion (Magnesia) in *Castanea sativa* (Pantidou 1990)
Cortinarius purpurascens (Fr.) Fr.
(Diamandis 1985); in *Abies cephalonica* and *Castanea sativa* (Diamandis 1992)
Cortinarius rigens (Pers.: Fr.) Fr.
Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)

Cortinarius salor Fr.
in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)
Cortinarius semisanguineus (Fr.) Gillet
in *Abies borisii-regis* (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)
Cortinarius splendens Henry
Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Cortinarius subfulgens Orton
in *Abies borisii-regis* (Diamandis 1985); (Diamandis 1992)
Cortinarius torvus Fr.
in *Fagus* sp. (Maire & Politis 1940)
Cortinarius traganus (Weinm.: Fr.) Fr.
in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Gardiki (Fthiotida) in *Abies* sp. (this work)
Cortinarius trivialis Lange
in *Quercus pubescens* (Diamandis 1992); in *Quercus conferta* (Diamandis & Perlerou 1990)
Cortinarius venetus Fr.
(Maire & Politis 1940)

Galerina autumnalis (Peck) Sing. & A.H. Smith
Evoia in *Pinus* sp. (Pantidou 1990)
Galerina camerina (Fr.) Kühn.
on *Abies* sp. and *Pinus nigra* (Maire & Politis 1940)
Galerina hypnorum (Schrank: Fr.) Kühn.
(Maire & Politis 1940)
Galerina marginata (Fr.) Kühn.
on conifers and on *Fagus* sp. (Maire & Politis 1940); Vassilika (Thessaloniki) on conifers litter (Minter 1988); on *Abies cephalonica* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)
Galerina mycenopsis (Fr.) Kühn.
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Pinus brutia* (Diamandis 1992)
Galerina paludosa (Fr.) Kühn.
in *Pinus brutia* (Diamandis 1985)
Galerina unicolor (Fr.) Singer
in *Pinus* sp. and *Abies* sp. (Pantidou 1973); Mt. Parnitha (Attiki), Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1980)

Gymnopilus penetrans (Fr.: Fr.) Murr.
Chrisovitsi (Arkadia) on *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); on *Abies borisii-regis* (Diamandis 1985); on *Abies borisii-regis* (Diamandis & Perlerou 1990); Mt. Parnassos (Fokida) on *Abies cephalonica* (Diamandis & Perlerou 1994); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Hebeloma anthracophilum Maire
(Maire & Politis 1940)
Hebeloma crustuliniforme (Bull.) Quél.
(Maire & Politis 1940); Mt. Parnitha (Attiki), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); in *Cedrus deodara* plantations (Diamandis 1983); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); in *Abies borisii-regis* (Diamandis 1992)
Hebeloma eburneum Mal.
Trikala (Korinthia) in *Abies cephalonica* (Pantidou et al. 1983); Attiki and Korinthia in *Pinus* sp. and *Abies* sp. (Pantidou 1990)
Hebeloma mesophaeum (Pers.: Fr.) Quél.
(Maire & Politis 1940)
Hebeloma sinapizans (Paulet: Fr.) Gill.
in conifers and *Fagus* sp. (Maire & Politis 1940); in *Quercus conferta* (Diamandis & Perlerou 1990); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)
Hebeloma sinuosum (Fr.) Quél.
(Diamandis 1985)
Hebeloma testaceum (Batsch: Fr.) Quél.
Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1980)

Inocybe bongardii (Weinm.) Quél.
in *Abies cephalonica* (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)
Inocybe commutabilis Furr.
in *Pinus brutia* (Diamandis 1992)
Inocybe destricta Fr.
(Diapoulis 1939)
Inocybe dulcamara (A. & S.: Pers.) Kummer
in *Pinus nigra* (Maire & Politis 1940)
Inocybe eutheles (Berk. & Br.) Quél.
NPR of Mt. Olympos in *Pinus nigra* (Diamandis & Perlerou 1994); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)
Inocybe fastigiata (Schaeff.: Fr.) Quél.
in *Abies* sp., *Fagus* sp. and *Quercus macrolepis* (Maire & Politis 1940); NPR of Mt. Olympos and NPR of Pindos in *Fagus sylvatica* (Avtzis & Diamandis 1988); in *Quercus* sp. (Diamandis 1992)
Inocybe geophylla var. *alba* Pat.: Schum.
in *Abies*, *Pinus halepensis* and *P. nigra* (Maire & Politis 1940)
Inocybe geophylla var. *lilacina* (Peck) Gill.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Abies cephalonica* and *Fagus sylvatica* (Diamandis 1983); NPR of Mt. Olympos and NPR of Pindos in *Fagus sylvatica* (Avtzis & Diamandis 1988); (Pantidou 1990); in *Castanea*

sativa, *Quercus* sp., *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Inocybe hystrix (Fr.) Karst.
in *Pinus halepensis* (Maire & Politis 1940)
Inocybe lacera (Fr.: Fr.) Kummer
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)
Inocybe maculata Boud.
in *Castanea* sp. (Maire & Politis 1940)
Inocybe perlata (Cooke) Sacc.
in *Quercus conferta* (Diamandis 1992)
Inocybe petiginosa (Fr.: Fr.) Gillet
(Diamandis 1985); in *Fagus sylvatica* (Diamandis 1992)
Inocybe piriodora (Pers.: Fr.) Kummer
(Maire & Politis 1940)
Inocybe praetervisa Quél.
in *Pinus nigra* (Maire & Politis 1940)
Inocybe serotina Peck
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)

Crepidotaceae:
Crepidotus applanatus (Pers.: Pers.) Kummer
NPR of Mt. Olympos on *Abies borisii-regis* (Diamandis & Perlerou 1990); on *Fagus* sp. (Diamandis 1992)
Crepidotus calolepis (Fr.) Karst
on *Pinus halepensis* and *Platanus* sp. (Maire & Politis 1940)
Crepidotus mollis (Fr.) Staude
on *Quercus* sp. (Diapoulis 1939); on *Platanus* sp. (Maire & Politis 1940); on *Platanus orientalis* (Pantidou 1990); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)
Crepidotus perpusillus (Fr.) Maire
on *Fagus* sp. (Maire & Politis 1940)
Crepidotus sphaerosporus (Pat.) Lange)
on *Fagus* sp. (Maire & Politis 1940)
Crepidotus variabilis (Pers.: Fr.) Kummer
on *Abies* sp. (Maire & Politis 1940); Mt. Olympos (Minter 1988); NPR of Mt. Olympos on *Fagus sylvatica* (Avtzis & Diamandis 1988)

Tubaria furfuracea (Pers.: Fr.) Gill.
Stavronikita Monastery (Agion Oros), Mt. Olympos in *Fagus sylvatica* (Minter 1988); in mixed forests of *Fagus orientalis* and *Pinus nigra* (Diamandis 1992)

Entolomataceae:
Clitopilus prunulus (Scop.: Fr.) Kummer
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); in *Pinus* sp. and *Abies* sp. (Pantidou 1990)

Entoloma cetratum (Fr.: Fr.) Moser {= *Nolanea cetrata* (Fr.: Fr.) Kummer}
in *Abies cephalonica* (Diamandis 1985)

Entoloma clypeatum (L.: Fr.) Kummer
Portaria (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984)
Entoloma hirtipes (Schum.: Fr.) Moser {= *Nolanea hirtipes* (Schum.: Fr.) Kummer}
(Diamandis 1985); NPR of Mt. Olympos (Avtzis & Diamandis 1988); Mt. Oiti (Fthiotida) (Pantidou 1990); in fields and in *Pinus brutia* (Diamandis 1992)
Entoloma incanum (Fr.: Fr.) Hessler
Kefallonia (Pantidou 1990)
Entoloma nidorosum (Fr.) Quél.
in *Fagus* sp. (Maire & Politis 1940)
Entoloma papillatum (Bres.) Dennis {= *Nolanea mammosa* subsp. *papillata* (Bres.) Konrad & Maubl.}
Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984)
Entoloma porphyropheum (Fr.) Karst.
in *Cupressus* sp. plantations (Diamandis 1992)
Entoloma resutum (Fr.) Quél.
(Maire & Politis 1940)
Entoloma sinuatum (Fr.) Kummer
in *Fagus* spp. (Diamandis 1992); NPR of Mt. Olympos in *Fagus* sp. and *Quercus conferta* (Diamandis & Perlerou 1994); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Entoloma staurosporum (Bres.) Hk. {= *Rhodophyllus staurosporus* (Bres.) Lange}
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)

Rhodocybe mundula (Lasch) Sing.
Mt. Pilion (Magnesia) in *Fagus sylvatica* (Pantidou 1973)
Rhodocybe nitellina (Fr.) Sing.
Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1980)
Rhodocybe truncata (Schff.: Fr.) Sing.
Mt. Olympos in *Quercus* sp. and in *Abies* sp. (Minter 1988)

Hygrophoraceae:
Hygrocybe chlorophana (Fr.) Wünsche
(Maire & Politis 1940)
Hygrocybe coccinea (Schaeff.: Fr.) Kummer {= *Hygrophorus coccineus* (Schaeff.: Fr.) Fr.}
(Maire & Politis 1940); Tatoi (Attiki) in conifers (Pantidou 1990); in *Abies cephalonica* (Diamandis 1992)
Hygrocybe conica (Scop.: Fr.) Kummer {= *Hygrophorus conicus* (Scop.: Fr.) Fr.}
(Maire & Politis 1940); in *Abies cephalonica* (Pantidou 1973); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Milies and Tsangaratha (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); in *Abies borisii-regis* (Diamandis & Perlerou 1990); in *Abies cephalonica* (Diamandis & Perlerou 1994); Andros in *Quercus* sp. (Lizon, pers. comm.)
Hygrocybe fornicata (Fr.) Singer
(Maire & Politis 1940)
Hygrocybe marchii (Brs.) Sing.

(Diamandis 1985), NPR of Mt. Olympos in *Pinus nigra* (Avtzis & Diamandis 1988)
Hygrocybe nigrescens (Quél.) Kühn.
in *Pinus brutia, Abies cephalonica* and *Castanea sativa* (Diamandis 1992)
Hygrocybe nivea (Scop.) Fr.
in fields (Diamandis 1992)
Hygrocybe psittacina (Schaeff.: Fr.) Wünsche {= *Hygrophorus psittacinus* (Schaeff.: Fr.) Fr.}
NPR of Mt. Olympos in *Quercus coccifera* (Diamandis & Perlerou 1990)
Hygrocybe strangulata P. Orton
in *Pinus nigra* (Diamandis 1992)
Hygrocybe unguinosa (Fr.) Karsten
Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Hygrophorus acutonicus (Clem.) Smith {= *Hygrocybe acutoconica* (Clem.: Woods) Sing.}
(Maire & Politis 1940); in *Abies cephalonica* and *Pinus nigra* (Pantidou 1973); Sami (Kefallonia) in *Quercus* sp. and *Arbutus unedo* (Pantidou 1990)
Hygrophorus agathosmus (Fr.) Fr.
Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Hygrophorus borealis Fr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Hygrophorus camarophyllus (Fr.) Dumée
Mt. Parnitha (Attiki) in *Pinus* sp. (Pantidou 1990)
Hygrophorus capreolarius Kalchbr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)
Hygrophorus chrysaspis Metr.
in *Fagus orientalis* (Diamandis 1992)
Hygrophorus chrysodon Fr.
Mt. Parnitha (Attiki), Vitina (Arkadia), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); NPR of Mt. Olympos in *Abies borisii-regis* and PF of Fracto (Drama) in *Fagus sylvatica* (Avtzis & Diamandis 1988); in *Abies cephalonica* and *Fagus orientalis* (Diamandis 1992)
Hygrophorus cossus (Sow: Berk.) Fr.
in *Quercus conferta* (Diamandis & Perlerou 1990); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)
Hygrophorus dichrous Kühner & Romagn.
in *Quercus conferta* (Diamandis 1992)
Hygrophorus eburneus (Bull.: Fr.) Fr.
in *Fagus* sp. (Maire & Politis 1940); Kakoskali (Mt. Ossa) in *Fagus sylvatica* (Pantidou & Gonou 1984); Mt. Ossa (Larissa) in *Abies* sp. (Pantidou 1990); in *Quercus conferta* (Diamandis 1992); Gardiki (Fthiotida) in *Quercus* sp. and Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Hygrophorus fuscoalbus (Fr.) sensu Moser
Glykadi (Thasos) in *Pinus* sp. (Pantidou 1990)
Hygrophorus hypothejus (Fr.: Fr.) Fr.

in *Pinus nigra* (Maire & Politis 1940); in *Pinus halepensis* (Pantidou 1973); Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); Attiki in *Pinus* sp. (Pantidou 1990); in *Pinus nigra* and *P. halepensis* (Diamandis 1992)

Hygrophorus marzuolus (Fr.) Bres.

Mt. Oiti (Fthiotida) in conifers (Pantidou 1990); Gardiki (Fthiotida) in *Abies* sp.

Hygrophorus niveus Fr.

(Maire & Politis 1940)

Hygrophorus olivaceoalbus Fr.

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Oropos and Dionysos (Attiki) in *Pinus* sp. (Pantidou 1990)

Hygrophorus penarius Fr.

Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Hygrophorus pudorinus Fr.

Mt. Parnitha (Attiki), Vitina (Arkadia), Ainos (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); in *Abies borisii-regis*, and in mixed forests of *Fagus* sp. and *Pinus sylvestris* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997); Gardiki (Fthiotida) in *Abies* sp. (this work)

Hygrophorus pustulatus Fr.

in *Pinus halepensis* Maire & Politis 1940]

Hygrophorus reae (Maire) Lange

Attiki in *Pinus* sp. (Pantidou 1990)

Hygrophorus russula (Fr.) Quél.

Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); in *Quercus coccifera* (Diamandis & Perlerou 1990); in *Quercus conferta* (Diamandis 1992)

Hygrophorus subradiatus Fr.

Attiki in conifers (Pantidou 1990)

Pluteaceae:

Pluteus atromarginatus (Konrad) Kühner

on *Abies borisii-regis* [Diamandis & Perlerou]; on *Abies borisii-regis* and *Picea abies* (Diamandis 1992), on *Abies cephalonica* (Diamandis & Perlerou 1994)

Pluteus cervinus (Schaeff.: Fr.) Kummer

on *Fagus* sp. and *Salix alba* (Maire & Politis 1940); (Avtzis & Diamandis 1988); Mt. Olympos on *Abies appolonis* (Minter 1988); PF of Fracto (Drama) on *Fagus sylvatica* (Diamandis & Perlerou 1990); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Pluteus nanus (Pers.: Fr.) Kummer

in Fagus sp. (Maire & Politis 1940)

Pluteus romellii (Britz.) Sacc. {= *Pluteus lutescens* (Fr.) Bres.}

Mt. Olympos (Minter 1988)

Pluteus ulmarius Quél.

PF of Fracto (Drama) on *Fagus orientalis* (Diamandis & Perlerou 1990)

Volvariella bombycina (Schaeff.: Fr.) Sing.

(Landerer 1854)

Volvariella gloiocephala (DC.: Fr.) Sing. {= *Volvariella speciosa* (Fr.: Fr.) Sing.}

(Maire & Politis 1940); Attiki, Korinthia, Evoia, Samos and Kefallonia (Keltemlidis 1990); Kefallonia (Pantidou 1990); in *Populus* sp. nurseries, and on manure (Diamandis 1992); Andros in pasture, in orchards, and among grass (Lizon, pers. comm.)
Volvariella murinella (Quél.) Moser: Courtec.
(Maire & Politis 1940)
Volvariella plumulosa (Lasch) Singer
in *Pinus halepensis* (Maire & Politis 1940)
Volvariella pusilla (Pers.: Fr.) Singer
(Maire & Politis 1940)
Volvariella volvacea (Bull.: Fr.) Singer
in *Pinus halepensis* (Maire & Politis 1940)

Strophariaceae:
Anellaria semiovata (Sow.: Fr.) Pears & Dennis
Gardiki (Fthiotida) on horse manure (this work)

Hypholoma elongatum (Pers.: Fr.) Ricken
Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984)
Hypholoma fasciculare (Huds.: Fr.) Kummer
on *Castanea* sp., *Fagus* sp. and *Quercus* sp. (Maire & Politis 1940); Vitina (Arkadia), Ainos (Kefallonia) on *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); NPR of Mt. Olympos on *Pinus nigra* and PF of Fracto (Drama) on *Picea abies* (Avtzis & Diamandis 1988); on *Castanea sativa*, *Quercus conferta*, *Abies borisii-regis* and *Fagus* sp. (Diamandis 1992); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)
Hypholoma sublateritium (Fr.) Quél.
on *Fagus sylvatica* (Diamandis 1983); (Pantidou 1990); in *Castanea sativa* (Diamandis 1992), Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)

Kuehneromyces mutabilis (Schaeff.: Fr.) Sing. & A.H. Smith
on *Quercus ilex*, *Q. conferta* and *Fagus* sp. (Diamandis 1992)

Panaeolina foenisecii (Pers.: Fr.) Mre.
Dion (Pella) (Minter 1988)

Panaeolus retirugis (Fr.) Quél.
(Maire & Politis 1940)
Panaeolus rickenii Hora
in *Quercus conferta* (Diamandis 1983); (Diamandis 1992); Gardiki (Fthiotida) on horse manure (this work)
Panaeolus sphinctrinus (Fr.) Quél. {= *Panaeolus campanulatus* var. *sphinctrinus* (Fr.) Quél.}
(Maire & Politis 1940); Kiourka (Attiki) in *Pinus halepensis* (Pantidou et al. 1983); (Diamandis 1985); Iberon Monastery (Agion Oros) on mule dung (Minter 1988); Kaisariani (Attiki in *Pinus halepensis* (Pantidou 1990); (Diamandis 1992)

Phaeomarasmius horizontalis (Bull.: St. Amans) Kühn. {= *Melanotus horizontalis*}
Meteora (Trikala) on *Quercus pubescens* (Minter 1988)

Pholiota adiposa (Fr.) Kummer
PF of Fracto (Drama) on *Fagus orientalis* (Diamandis & Perlerou 1990); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)
Pholiota albivelata Murr.
Kiourka (Attiki) in *Pinus* sp. (Pantidou 1990)
Pholiota alnicola (Fr.) Sing.
(Diamandis 1985)
Pholiota astragalina (Fr.) Singer
on *Abies borisii-regis* (Diamandis 1992)
Pholiota aurivella (Fr.) Kummer
on *Platanus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); on *Abies borisii-regis* (Diamandis 1992); Mt. Oiti (Fthiotida) on *Abies* sp. (this work)
Pholiota curvipes (Fr.) Quél.
(Pantidou 1973); Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1980)
Pholiota flammans (Fr.) Kummer
on *Abies cephalonica* and *Pinus sylvestris* (Diamandis 1992); Mt. Oiti (Fthiotida) on *Abies* sp.
Pholiota gummosa (Lasch.) Singer
Attiki in *Pinus* sp. (Pantidou 1990)
Pholiota lenta (Pers.: Fr.) Sing.
in *Fagus* sp. (Maire & Politis 1940); Attiki in *Abies* sp. (Pantidou 1990)
Pholiota lubrica (Fr.) Singer
Attiki in *Pinus* sp. (Pantidou 1990)
Pholiota mixta (Fr.) Sing.
on *Abies cephalonica* (Diamandis & Perlerou 1994)
Pholiota mutabilis (Schaeff.: Fr.) Kummer
on *Quercus conferta* (Diamandis 1983)
Pholiota spectabilis (Fr.) Gill.
(Maire & Politis 1940)
Pholiota squarrosa (Müll.: Fr.) Kummer
on *Fagus sylvatica* (Diamandis 1983); on *Fagus orientalis* (Diamandis 1992)

Psilocybe coprophila (Bull.: Fr.) Kummer
(Diamandis 1985); on manure (Diamandis 1992)
Psilocybe crobulus (Fr.) Kühn. & Romagn.
(Diamandis 1985); (Diamandis 1992)

Stropharia aeruginosa (Curt.: Fr.) Quél.
in *Fagus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Hania (Magnesia) in *Fagus sylvatica* [Pantidou 1973, (Pantidou & Gonou 1984); Korinthia in *Pinus halepensis* (Pantidou et al. 1983); Korinthia in *Pinus* sp. (Pantidou 1990); in *Pinus sylvestris* (Diamandis & Perlerou

1990); in *Picea abies* and *Fagus sylvatica* (Diamandis 1992); Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997); Gardiki (Fthiotida) in *Abies* sp. (this work)

Stropharia coronilla (Bull.: Fr.) Quél.
(Maire & Politis 1940); in fields (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)

Stropharia semiglobata (Batsch: Fr.) Quél. {= *Stropharia stercocaria* (Schum.: Fr.) Quél.
(Maire & Politis 1940); (Diamandis 1985); Iberon Monastery (Agion Oros) on mule dung (Minter 1988); (Pantidou 1990); on horse manure (Diamandis 1992)

Stropharia squamosa (Pers.: Fr.) Quél.
in *Fagus sylvatica* (Diamandis 1985); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)

Tricholomataceae:

Armillaria mellea (Wahl.: Fr.) Kummer
Quercus sp. and *Fagus sylvatica* (Diapoulis 1939); *Achillea millefolium, Citrus deliciosa, Dahlia* sp., *Euonymus japonicus, Ficus carica, Juglans regia, Lavandula* sp., *Malus sylvestris, Olea europea, Pinus halepensis, Pistacia lentiscus, Prunus avium, Prunus cerasus, Prunus dulcis, Punica granatum, Pyrus communis, Rhamnus* sp., *Rosa* sp., *Rubus idaeus, Solanum tuberosum* and *Vitis vinifera* (Sarejanni 1939); on *Citrus deliciosa, Dahlia* sp., *Euonymus japonicus, Ficus carica, Junglans regia, Lavandula* sp., *Pinus halepensis, Prunus avium, Prunus dulcis, Prunus mahaleb, Punica granatum, Pyrus communis, Rhamnus* sp., *Rubus idaeus* and *Solanum tuberosum* (Maire & Politis 1940); *Populus* sp. (Sarejanni et al. 1952); Grevena on *Vitis vinifera* [Sarejanni et al. 1954]; *Abies* sp., *Pinus* sp. and *Quercus* sp. (Kailidis 1962); *Castanea sativa* (Kailidis 1967); Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Pertouli (Trikala) on *Abies borisii-regis* and Mt. Parnitha (Attiki) on *Abies cephalonica* (Kailidis & Markalas 1981); Hania (Magnesia) on *Fagus sylvatica* (Pantidou & Gonou 1984); on *Fagus sylvatica* (Avtzis & Diamandis 1988); Attiki on *Pinus* sp. (Pantidou 1990); on *Castanea sativa, Quercus* sp., *Pinus halepensis, P. nigra, Abies cephalonica, A. borisii-regis, Juglans regia, Olea europaea, Prunus* spp. (Diamandis 1992); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)

Baeospora myosura (Fr.) Sing.
NPR of Pindos on *Pinus nigra* (Avtzis & Diamandis 1988)

Calocybe carnea (Bull.: Fr.) Kühn.
(Diamandis 1985)

Calocybe cerina (Pers.: Fr.) Donk.
in mixed forests of *Abies borisii-regis* and *Pinus nigra* (Diamandis 1992)

Cantharellula cyathiformis (Bull.: Fr.) Singer
(Diapoulis 1939); (Maire & Politis 1940); Mt. Parnitha (Attiki), Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)

Clitocybe alexandri (Gillet) Konr.

Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Clitocybe cerussata (Fr.) Kummer

Mt. Pilion (Magnesia) in *Fagus sylvatica* (Pantidou 1973); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Clitocybe cirrhata (Schum.: Fr.) Kummer

NPR of Mt. Olympos hyperparasitic on agarics in *Fagus sylvatica* (Diamandis & Perlerou 1990)

Clitocybe clavipes (Pers.: Fr.) Kummer

Mt. Parnitha (Attiki) in *Abies cephalonica* and *Pinus* spp. (Pantidou 1973, Pantidou 1980); Mt Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Fagus sylvatica* (Diamandis 1983); in *Quercus conferta, Abies cephalonica, A. borisii-regis* and *Pinus nigra* (Diamandis 1992)

Clitocybe dealbata (Sow.: Fr.) Kummer

Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Clitocybe dicolor (Pers.) J. Lange

(Diamandis 1985)

Clitocybe ditopus (Fr.: Fr.) Gill.

(Diamandis 1985)

Clitocybe geotropa (Bull.) Quél.

in *Abies* (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* and *Pinus* spp. (Pantidou 1980); Mt. Parnitha (Attiki) in *Abies cephalonica*, and Ayia Trias (Attiki) in *Pinus halepensis* (Pantidou et al. 1983); Mt. Pilion (Magnesia) in *Fagus sylvatica* (Pantidou 1990); in *Quercus pubescens* and *Abies cephalonica* (Diamandis 1992)

Clitocybe gibba (Pers.: Fr.) Kummer {= *Clitocybe infundibuliformis* (Schaeff.) Quél.}

in *Castanea* sp. and *Fagus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); in *Abies* sp., *Pinus* sp., *Castanea* sp. and *Fagus* sp. (Pantidou 1990), in *Pinus brutia, P. maritima, Abies cephalonica, A. borisii-regis, Fagus sylvatica* and *Cadtanea sativa* (Diamandis 1992)

Clitocybe gilva (Pers.: Fr.) Roze

(Maire & Politis 1940); Kakoskali (Mt. Ossa) in *Fagus sylvatica* (Pantidou & Gonou 1984)

Clitocybe harperi Murr.

Attiki in *Pinus* sp. (Pantidou 1990)

Clitocybe hydrogramma (Bull.: Fr.) Kummer

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)

Clitocybe incilis (Fr.) Gillet

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)

Clitocybe inornata (Fr.) Gillet

in *Pinus halepensis* (Pantidou 1973); Rovies (Evoia) in *Pinus* sp. (Pantidou 1990)

Clitocybe lignatilis (Pers.: Fr.) Karst. {= *Pleurotus lignatilis* (Pers.: Fr.) Kummer
= *P. fimbriatus* (Bolt.: Fr.) Gillet}

(Maire & Politis 1940); on *Fagus sylvatica* (Diamandis 1992)
Clitocybe metachroa (Fr.) Kummer
Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Clitocybe odora (Fr.) Kummer
in *Abies* sp., *Fagus* sp. and *Pinus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki), Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1980); Mt Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Mt. Parnitha (Attiki) and Trikala (Korinthia) in *Pinus halepensis* (Pantidou et al. 1983); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); in *Quercus conferta*, *Fagus sylvatica*, *Pinus* sp., *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)
Clitocybe orbiriformis (Fr.) Quél.
in *Abies* sp. and *Pinus* sp. (Maire & Politis 1940)
Clitocybe phyllophila (Fr.) Kummer
in *Pinus nigra* (Maire & Politis 1940)
Clitocybe rivulosa (Pers.: Fr.) Kummer
in fields (Diamandis 1992); in *Pinus brutia* (Diamandis & Perlerou 1990)
Clitocybe sinopica (Fr.: Fr.) Kummer
in *Quercus macrolepis* (Maire & Politis 1940)
Clitocybe squamulosa (Fr.) Kummer
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Clitocybe vibecina (Fr.) Quél.
in *Pinus nigra* (Diamandis 1992); in *Pinus brutia* (Diamandis & Perlerou 1990)

Clitocybula lacerata (Scop.: Lasch) Metr.
Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1980)

Collybia acervata (Fr.) Kummer
(Maire & Politis 1940)
Collybia butyracea (Bull.: Fr.) Kummer
in *Quercus conferta* and *Fagus* sp. (Diamandis 1992), Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); Kerasia (Evoia) in *Pinus nigra*, and Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Collybia cirrhata (Pers.) Kummer
in *Fagus orientalis* and *Abies cephalonica* (Diamandis 1992)
Collybia confluens (Pers.: Fr.) Kummer
in *Pinus brutia* (Diamandis 1985); in mixed forests of *Castanea sativa* and *Fagus orientalis* (Diamandis 1992)
Collybia conigena (Pers.: Fr.) Quél.
on *Pinus nigra* (Maire & Politis 1940)
Collybia dryophila (Bull.: Fr.) Kummer
in *Quercus coccifera* and *Pinus halepensis* (Maire & Politis 1940); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); Attiki in *Pinus* sp. (Pantidou 1990); in *Fagus orientalis* and *Quercus coccifera* (Diamandis 1992); Ziakas (Grevena) in *Abies* sp. (this work)

Collybia erythropus (Pers.: Fr.) Kummer {= *Marasmius erythropus* (Pers.: Fr.) Fr.
Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); in *Castanea sativa* and *Fagus sylvatica* (Diamandis & Perlerou 1994)
Collybia fusipes (Bull.: Fr.) Quél.
in *Castanea* sp., *Fagus* sp. and *Platanus* sp. (Maire & Politis 1940); in *Castanea sativa*, *Fagus* sp. and *Platanus* sp. (Diamandis 1992)
Collybia lacerata (Lasch.) Quél.
(Maire & Politis 1940)
Collybia tuberosa (Bull.: Fr.) Kummer
(Diamandis 1985); on *Lactarius* sp. basidiomata (Diamandis 1992)

Flammulina velutipes (Curt.: Fr.) Karst. {= *Collybia velutipes* (Curt.: Fr.) Kummer}
in *Quercus* sp. and *Fagus* sp. (Diapoulis 1939); in *Salix alba* (Maire & Politis 1940); Vitina (Arkadia) on *Abies cephalonica* (Pantidou 1990)

Hohenbuehelia geogenia (DC.: Fr.) Singer
Mt. Parnitha (Attiki), Vitina (Arkadia), Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Gardiki (Fthiotida) in *Quercus* sp. and Mt. Parnitha (Attiki) in *Abies cephalonica* (this work)
Hohenbuehelia petaloides (Bull.: Fr.) Schulzer
in *Fagus* sp. and *Quercus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Hypsizygus tessulatus (Bull.: Fr.) Singer
on *Fagus sylvatica* (Diamandis 1992)

Laccaria amethystina (Bolt.: Hooker) Murr. {= *Laccaria amethystea* (Bull.) Murr.}
in *Fagus* sp. (Maire & Politis 1940); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); Elati (Karditsa) (Minter 1988); in *Castanea sativa* (Diamandis & Perlerou 1990); in *Fagus* spp. (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Laccaria laccata (Scop.: Fr.) Cke.
in *Fagus* sp. and *Pinus nigra* (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Hania (Magnesia) in *Fagus sylvatica* and Milies (Magnesia) in *Castanea sativa* [Pantidou 1973, (Pantidou & Gonou 1984); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou et al. 1983); Elati (Karditsa) in *Abies* sp. (Minter 1988); (Pantidou 1990); in *Abies cephalonica*, *A. borisii-regis*, *Pinus nigra*, *P. brutia*, *P. sylvestris*, *Castanea sativa*, *Fagus* sp. and *Quercus* sp. (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Laccaria proxima (Boud.) Pat.
(Maire & Politis 1940)
Laccaria tortilis (Bolt.) Cke
in *Pinus brutia* (Diamandis 1992)

Lepista inversa (Scop.: Fr.) Pat. {= *Clitocybe flaccida* (Sow.: Fr.) Kummer}
(Diamandis 1983); in *Pinus brutia* and *Fagus sylvatica* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Lepista luscina (Fr.: Fr.) Singer
in *Pinus brutia* (Diamandis & Perlerou 1990)
Lepista nebularis (Batsch: Fr.) Harmaja {= *Clitocybe nebularis* (Batsch: Fr.) Kummer}
Hania (Magnesia) and Kakoskali (Mt. Ossa) in *Fagus sylvatica* [Pantidou 1973, (Pantidou & Gonou 1984); in *Quercus conferta*, and in mixed forests of *Pinus nigra* and *Fagus sylvatica* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Lepista nuda (Bull.: Fr.) Cke {= *Tricholoma nudum* (Bull.: Fr.) Kummer
= *Clitocybe nuda* (Fr.) Bigelow & Smith}
Dionysos (Attiki) in *Pinus halepensis* (Pantidou et al. 1983); Stavronikita Monastery (Agion Oros), Vassilika (Thessaloniki) in *Quercus macedonica* (Minter 1988); Mt. Penteli (Attiki) and Sykamnia (Lesvos) (Keltemlidis 1990); Attiki and Evoia in *Pinus* sp. and Mt. Parnassos (Fokida) in *Abies* sp. (Pantidou 1990); in *Pinus brutia, Abies cephalonica, A. borisii-regis* and *Castanea sativa*, and in *Cedrus libani* and *Cupressus glabra* plantations (Diamandis 1992); Andros in *Cupressus sempervirens* (Lizon, pers. comm.); Mt. Oxia (Fthiotida) in *Fagus sylvatica* and Gardiki and Mt. Oiti (Fthiotida) in *Abies* sp. (this work)
Lepista saeva (Fr.) P. Orton
(Diamandis 1985)
Lepista sordida (Fr.) Singer {= *Clitocybe tarda* Peck}
in *Abies cephalonica* and *Pinus halepensis* (Pantidou 1973); Mt. Parnitha (Attiki), Chrisovitsi (Arkadia), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1980); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou et al. 1983); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); in *Pinus* sp., *Abies* sp., *Fagus* sp. and *Quercus* sp. (Pantidou 1990); Andros (Lizon, pers. comm.)

Leptoglossum griseopallidum (Desm.) {= *Phaeotellus griseopallida* (Desm.) Kühn. & Lamoure = *Omphalina griseopallida* (Desm.) Quél.}
in abandoned fields (Diamandis 1992), NPR of Samaria (Crete) (Diamandis & Perlerou 1994)

Leucopaxillus amarus (Alb. & Schw.) Kühner
in *Abies* sp. and *Pinus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou et al. 1983); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)
Leucopaxillus giganteus (Sow.: Fr.) Sing. {= *Clitocybe gigantea* (Sow.:Fr.) Quél.}
in *Castanea sativa* (Diamandis 1985); NPR of Mt. Olympos in *Castanea sativa* (Diamandis & Perlerou 1990)
Leucopaxillus mirabilis (Bres.) Kühner
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)

Lyophyllum aggregatum (Schaeff.: Secr.) Kühner

in *Castanea* sp. (Diapoulis 1939)
Lyophyllum connatum (Schum.: Fr.) Sing.
PF of Fracto (Drama) in *Pinus sylvestris* (Diamandis & Perlerou 1990)
Lyophyllum decastes (Fr.: Fr.) Sing.
Elati (Karditsa) in *Abies* sp. (Minter 1988); in *Pinus brutia* (Diamandis 1992)
Lyophyllum immundum (Berk.) Kühner s. Moser
(Maire & Politis 1940); Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984)
Lyophyllum infumatum (Bres.) Kühner
in *Abies* sp. and *Pinus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Attiki in *Pinus* sp. (Pantidou 1990)
Lyophyllum semitale (Fr.) Kühner
Tripoli (Arkadia) in *Pinus* sp. (Pantidou 1990)

Marasmiellus ramealis (Bull.: Fr.) Sing. {= *Marasmius ramealis* (Bull.: Fr.) Fr.}
on *Quercus conferta* (Diamandis 1992)

Marasmius alliaceus (Jacq.: Fr.) Fr.
in *Fagus* sp. (Maire & Politis 1940); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Marasmius androsaceus L.: Fr.
in *Pinus sylvestris* (Diamandis 1992), in *Pinus nigra* (Diamandis 1985), in *Olea europaea* (Heufler 1868), in *Quercus coccifera* (Maire & Politis 1940)
Marasmius anomalus Lasch
(Maire & Politis 1940)
Marasmius bresadolae Kühner & Rom.
in *Fagus sylvatica* forests (Maire & Politis 1940)
Marasmius bulliardii Quél.
in *Castanea sativa* (Maire & Politis 1940)
Marasmius epiphyllus (Pers.: Fr.) Fr.
on *Quercus conferta* (Diamandis 1983)
Marasmius oreades (Bolt.: Fr.) Fr.
(Maire & Politis 1940); Milies (Magnesia) on *Castanea sativa* (Pantidou & Gonou 1984); (Diamandis 1992)
Marasmius perforans Fr.
in *Abies* sp. (Maire & Politis 1940); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)
Marasmius rotula (Scop.: Fr.) Fr.
on *Castanea sativa* (Maire & Politis 1940); on *Quercus conferta* (Diamandis 1983); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); Milies (Magnesia) on *Castanea sativa* (Pantidou & Gonou 1984); NPR of Mt. Olympos on *Abies borisii-regis* and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); on *Castanea sativa* (Diamandis 1992)
Marasmius scorodonius Fr.
Hania (Magnesia) and Kakoskali (Mt. Ossa) on *Pinus* sp. and *Fagus sylvatica* (Pantidou 1990, Pantidou & Gonou 1984); in *Fagus sylvatica* (Maire & Politis 1940)

Marasmius wynnei Berk. & Briosi
in *Pinus halepensis* (Maire & Politis 1940)

Megacollybia platyphylla (Pers.: Fr.) Kotl. & Pouz. {= *Tricholomopsis platyphylla* (Pers.: Fr.) Sing., =*Collybia platyphylla* (Pers.: Fr.) Kummer}
in *Abies cephalonica* and *Fagus sylvatica* (Pantidou 1973); Mt. Pilion (Magnesia) on *Abies* sp. (Pantidou 1990); Hania (Magnesia) on *Fagus sylvatica* (Pantidou & Gonou 1984); Mt. Parnitha (Attiki) and Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980)

Melanoleuca arcuata (Fr.) Singer
NPR of Mt. Olympos in *Pinus brutia* (Diamandis & Perlerou 1990)
Melanoleuca cognata (Fr.) Konrad & Maubl.
Evoia in *Abies* sp. (Pantidou 1990)
Melanoleuca melaleuca (Pers.: Fr.) Murr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); Mt. Olympos (Minter 1988); in *Cupressus glabra*, *A. borissi-regis* and *Pinus brutia* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia (Fthiotida) in *Fagus sylvatica* and Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)

Micromphale brassicolens (Romagn.) P. Orton
in *Pinus nigra*, *Fagus sylvatica* and *Abies borisii-regis* (Diamandis 1985); in mixed forests of *Pinus nigra* and *Fagus* sp. (Diamandis 1992)
Micromphale perforans (Hofm.: Fr.) Singer
in *Abies cephalonica* (Diamandis 1992)

Mycena abramsii Murr. {= *Mycena preacox* Vel.}
in *Castanea sativa* (Diamandis 1992)
Mycena acicula (Schaeff.: Fr.) Kummer
on *Fagus sylvatica* (Diamandis 1992)
Mycena adonis (Bull.: Fr.) S.F. Gray
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)
Mycena aetites (Fr.) Quél.
in *Pinus brutia* (Diamandis 1992); NPR of Samaria (Crete) on *Pinus brutia* and *Cupressus sempervirens* (Diamandis & Perlerou 1990)
Mycena alcalina (Fr.) Kummer
in *Abies* sp. (Maire & Politis 1940); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); NPR of Mt. Olympos in *Abies borisii-regis* and PF of Fracto (Drama) in *Picea abies* (Avtzis & Diamandis 1988); Mt. Dirfi (Evoia) (Pantidou 1990); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)
Mycena amicta (Fr.) Quél.
in *Pinus halepensis* forests (Maire & Politis 1940)
Mycena atrocyanea (Batsch: Fr.) Gillet
in *Pinus pinea* (Diamandis 1992)

Mycena capillaripes Peck {= *Mycena capillaris* (Schum.: Fr.) Kummer}
in *Fagus* sp. (Maire & Politis 1940)
Mycena chlorantha (Fr.) Kummer
Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1990)
Mycena cortiana Hora
on *Fagus sylvatica* (Diamandis 1983)
Mycena crocata (Schrad.: Fr.) Kummer
in *Fagus sylvatica* (Diamandis 1985); NPR of Mt. Olympos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988)
Mycena epipterygia (Scop.: Fr.) S.F. Gray
Mt. Parnitha (Attiki), Chrisovitsi (Arkadia), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); NPR of Mt. Olympos in *Pinus nigra* (Avtzis & Diamandis 1988); in *Abies borisii-regis, Castanea sativa* and *Quercus conferta* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)
Mycena erubescens Hoehnel
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Mycena filopes (Bull.: Fr.) Kummer
(Diamandis 1992)
Mycena flavescens Vel.
(Diamandis 1985)
Mycena galericulata (Scop.: Fr.) S.F. Gray {= *Mycena rugosa* (Fr.) Quél.}
in *Abies* sp., *Fagus* sp. and *Pinus nigra* (Maire & Politis 1940); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); Tsangaratha (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); in *Fagus orientalis* and *Pinus nigra* (Diamandis 1992); Mt. Oxia (Fthiotida) and Mt. Oiti (Fthiotida) in *Fagus sylvatica* and *Abies* sp. respectively (this work)
Mycena galopus (Pers.: Fr.) Kummer
(Maire & Politis 1940); (Diamandis 1985); NPR of Mt. Olympos and PF of Fracto (Drama) in *Fagus syvatica* (Avtzis & Diamandis 1988); in *Fagus* sp. (Diamandis 1992)
Mycena haematopus (Pers.: Fr.) Kummer
NPR of Mt. Olympos and NPR of Pindos in *Fagus sylvatica* (Avtzis & Diamandis 1988); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Mycena inclinata (Fr.) Quél.
in *Quercus conferta* (Diamandis 1983); (Pantidou 1990), Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Mycena lactea (Pers.: Fr.) Quél.
in *Pinus halepensis* (Maire & Politis 1940); in *Pinus* spp. (Diamandis 1983); in *Pinus brutia* and *Pinus maritima* (Diamandis 1985); NPR of Mt. Olympos and NPR of Pindos in *Pinus nigra* (Avtzis & Diamandis 1988); Attiki in *Pinus* sp. (Pantidou 1990); in *Pinus halepensis* (Diamandis 1992)
Mycena leucogala (Cooke) Sacc.
on *Quercus conferta* (Diamandis 1983); on *Castanea sativa* (Diamandis 1985)
Mycena maculata Karst.
in *Fagus sylvatica* (Diamandis 1985); Kerasia (Evoia) in mixed forest of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Mycena metata (Fr.) Kummer
in *Pinus halepensis* and *P. nigra* (Maire & Politis 1940)
Mycena olida Bres.
in *Castanea sativa* (Diamandis 1992)
Mycena oortiana Hora
NPR of Mt. Olympos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988)
Mycena polyadelpha (Lasch.) Kühn.
Mt. Olympos in *Quercus coccifera* (Minter 1988)
Mycena polygramma (Bull.: Fr.) S.F. Gray
in *Quercus* sp. (Maire & Politis 1940); Mt. Pilion (Magnesia) in *Castanea sativa* (Pantidou 1990); in *Quercus conferta* (Diamandis 1992)
Mycena pura (Pers.: Fr.) Kummer
in *Abies* sp., *Fagus sylvatica*, *Pinus* sp. and *Quercus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Hania (Magnesia) and Kakoskali (Mt. Ossa) in *Fagus sylvatica* (Pantidou & Gonou 1984); Pantokratoros Monastery (Agion Oros) (Minter 1988); in *Pinus* sp. (Pantidou 1990); in *Abies cephalonica*, *A. borisii-regis*, *Pinus* sp., *Quercus* spp. and *Fagus* spp. (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Mycena quercus-ilicis Kühn.
Stavronikita Monastery and Iberon Monastery (Agion Oros) on *Quercus ilex*, Mt. Olympos on *Quercus ilex* (Minter 1988)
Mycena rosea (Bull.) Gramberg
on *Quercus conferta* (Diamandis & Perlerou 1990); in *Fagus sylvatica* and *F. orientalis* (Diamandis 1992)
Mycena rosella (Fr.) Kummer
in *Pinus nigra* (Maire & Politis 1940)
Mycena seynii Quél.
in *Pinus halepensis* (Maire & Politis 1940); Thrakomakedones (Attiki) on *Pinus halepensis* (Pantidou et al. 1983); Attiki in *Pinus* sp. (Pantidou 1990); on *Pinus halepensis*, *P. brutia* and *P. radiata* (Diamandis 1992)
Mycena viscosa (Secr.) Maire
(Maire & Politis 1940); PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); on *Picea abies* (Diamandis 1992)
Mycena vulgaris (Pers.: Fr.) Kummer
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Thasos in *Pinus* sp. (Pantidou 1990); in *Pinus brutia* (Diamandis 1992)

Mycoacia uda (Fr.) Donk.
on *Arbutus unedo* (Diamandis 1985)

Omphalia thessala Maire
in *Castanea sativa* (Maire & Politis 1940)
Omphalia vesuviana (Brig.) Sacc.

(Maire & Politis 1940)

Omphalina ericetorum (Fr.: Fr.) J. Lange {= *Omphalina umbellifera* (L.: Fr.) Quél.}
(Maire & Politis 1940); in *Pinus brutia* (Diamandis 1992)
Omphalina fibula (Fr.) Kummer
in *Pinus brutia* (Diamandis & Perlerou 1990)
Omphalina galericolor Romagn.
in *Castanea sativa* (Diamandis 1992)
Omphalina griseopallida (Desm.) Quél.
Omalos (Chania) in fields (Diamandis & Perlerou 1990)
Omphalina postii (Fr.) Singer
in *Pinus radiata* (Diamandis 1992), (Diamandis 1985)
Omphalina rustica (Fr.) Quél. s. Singer
(Maire & Politis 1940)

Oudemansiella longipes (Bull.) Moser
Mt. Parnitha (Attiki), Vitina (Arkadia), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Abies cephalonica*, *A. borisii-regis* and *Fagus sylvatica* (Diamandis 1992); Gardiki (Fthiotida) in *Abies* sp. (this work)
Oudemansiella mucida (Schrad.: Fr.) Hühn.
NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Mt. Ossa (Larissa) on *Fagus sylvatica* (Pantidou 1990); on *Fagus* spp. (Diamandis 1992); Mt. Kissavos (Larissa) on *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia (Fthiotida) on *Fagus sylvatica* and Mt. Pilion (Magnesia) on *Fagus sylvatica* (this work)
Oudemansiella radicata (Relh.: Fr.) Sing.
(Pantidou 1990); on *Fagus* spp. (Diamandis 1992); Mt. Kissavos (Larissa) in *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997); Mt. Pilion (Magnesia) on *Fagus sylvatica* (this work)

Panellus mitis (Pers.: Fr.) Singer
Mt. Mainalon (Arkadia) on *Abies cephalonica* (Diamandis & Minter 1981); on *Pinus nigra*, *Picea abies*, *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)
Panellus serotinus (Fr.) Kühner
(Pantidou 1990); on *Fagus sylvatica* (Diamandis 1983)
Panellus stipticus (Bull.: Fr.) Karst. {= *Panus stipticus* Fr.}
on *Castanea sativa* (Maire & Politis 1940); on *Castana sativa* and on *Fagus sylvatica* (Diamandis 1983); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Kastanea on *Quercus* sp. (Minter 1988); on *Arbutus unedo* and *Quercus* sp. (Pantidou 1990); on *Quercus pubescens* and *Q. conferta* (Diamandis 1992)

Pseudoclitocybe cyathiformis (Bull.: Fr.) Sing. {= *Clitocybe cyathiformis* (Bull.: Fr.) Kummer}
(Avtzis & Diamandis 1988); in *Pinus nigra* and *Abies cephalonica* (Pantidou 1990), (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies*

cephalonica (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)

Resupinatus silvanus (Sacc.) Sing.
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)

Rhodocollybia maculata (A. & S.: Fr.) Sing. {= *Collybia maculata* (A. & S.: Fr.) Kummer}
(Diamandis 1985); in *Fagus* sp. (Diamandis 1992)

Rickenella fibula (Bull.: Fr.) Raith. {= *Mycena fibula* (Bull.: Fr.) Kühn.
= *Omphalia fibula* (Bull.: Fr.) Kummer}
in *Fagus* sp. (Maire & Politis 1940); on *Fagus sylvatica* (Diamandis 1985); in *Pinus radiata* (Diamandis 1992); in *Pinus brutia* (Diamandis & Perlerou 1994)

Rugosomyces onychicus (Fr.) Raithelhuber
Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Strobilurus tenacellus (Pers.: Fr.) Sing. {= *Collybia tenacella* (Pers.: Fr.) Kummer
= *Pseudohiatula tenacella* Metrod}
on *Pinus* sp. (Maire & Politis 1940); on *Pinus nigra* (Diamandis 1985); NPR of Mt. Olympos on *Pinus nigra* (Avtzis & Diamandis 1988); Holomondas (Halkidiki) on *Pinus nigra*, Kastanea on *Pinus nigra*, Mt. Olympos (Minter 1988); on *Pinus* sp. (Pantidou 1990); on *Pinus nigra* and *Pinus brutia* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Tephrocybe rancida (Fr.) Donk {= *Collybia rancida* (Fr.) Quél.}
in *Pinus nigra* (Maire & Politis 1940)

Tricholoma acerbum (Bull.: Fr.) Quél.
Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984)
Tricholoma albobrunneum (Pers.: Fr.) Kummer
in *Pinus brutia* (Diamandis & Perlerou 1990); Mt. Oiti (Fthiotida) in *Abies* sp. (this work)
Tricholoma argyraceum (Bull.: Fr.) Quél.
in *Pinus brutia* (Diamandis 1992)
Tricholoma atrosquamosum (Chev.) Sacc.
in *Quercus conferta* and *Abies cephalonica* (Diamandis 1992); Vitina (Arkadia), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Tricholoma aurantium (Schaeff.: Fr.) Ricken
in *Abies* sp. and *Pinus* sp. (Maire & Politis 1940); in *Pinus halepensis* (Pantidou 1973); Mt. Parnitha (Attiki), Vitina (Arkadia), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Tatoi (Attiki) in *Pinus halepensis*, and Trikala (Korinthia) in *Abies cephalonica* (Pantidou et al. 1983); Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); in *Pinus* sp. and *Quercus* sp. (Pantidou 1990); in *Abies cephalonica* and *Pinus halepensis* (Diamandis 1992)

Tricholoma caligatum (Viv.) Ricken
Korinthia on *Arbutus unedo* (Pantidou 1990); in *Pinus halepensis* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Tricholoma columbetta (Fr.) Kummer
NPR of Mt. Olympos in *Fagus sylvatica* (Diamandis & Perlerou 1994)
Tricholoma colossus (Fr.) Quél.
in *Pinus nigra* (Maire & Politis 1940)
Tricholoma equestre (L.: Fr.) Quél.
in *Pinus nigra* (Maire & Politis 1940)
Tricholoma flavovirens (Fr.) Lund.
Mt. Pilion (Magnesia) in *Fagus sylvatica* (Pantidou 1973), Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Tricholoma fracticum (Batsch) Kreisel
Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Tricholoma gausapatum (Fr.) Quél.
Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)
Tricholoma imbricatum (Fr.: Fr.) Kummer
in *Pinus nigra* (Maire & Politis 1940)
Tricholoma murinaceum Bull.
in *Pinus* sp. (Maire & Politis 1940)
Tricholoma orirubens Quél.
in *Abies* sp. and *Pinus* sp. (Maire & Politis 1940)
Tricholoma populinum Lange
in a *Populus* sp. plantation (Diamandis 1992)
Tricholoma portentosum (Fr.) Quél.
in *Pinus nigra* (Maire & Politis 1940)
Tricholoma psammopus (Kalchbr.) Quél.
Tatoi (Attiki) in conifers (Pantidou 1990)
Tricholoma resplendens (Fr.) Quél.
Mt. Parnitha (Attiki), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980)
Tricholoma saponaceum (Fr.) Kummer
in *Abies* sp. and *Pinus* sp. (Maire & Politis 1940); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1990); in a *Cedrus libani* plantation and in *Abies cephalonica* and *Pinus brutia* (Diamandis 1992)
Tricholoma senjuctum (Sow.: Fr.) Quél.
NPR of Mt. Olympos in *Fagus sylvatica* (Diamandis & Perlerou 1990)
Tricholoma squarrulosum Bres.
Mt. Parnitha (Attiki), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980); in *Cedrus* spp. (Diamandis 1983); Hania (Magnesia) in *Fagus sylvatica*, and Tsangaratha (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)
Tricholoma sulphureum (Bull.: Fr.) Kummer
in *Quercus pubescens* (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Hania (Magnesia) and Kakoskali (Mt. Ossa) in *Fagus sylvatica* (Pantidou & Gonou 1984)

Tricholoma terreum (Schaeff.: Fr.) Kummer
in *Pinus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) and Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Cupressus commune* (Diamandis 1983); NPR of Mt. Olympos in *Pinus nigra* (Avtzis & Diamandis 1988); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997); Mt. Oiti (Fthiotida) in *Abies* sp. (this work)
Tricholoma ustale (Fr.: Fr.) Kummer
Mt. Parnitha (Attiki) and Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980)
Tricholoma ustaloides Romagn.
in *Quercus conferta* (Diamandis & Perlerou 1994)
Tricholoma vaccinum (Pers.: Fr.) Kummer
in *Pinus brutia* (Diamandis 1992)

Tricholomopsis rutilans (Schaeff.: Fr.) Sing.
Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); on *Pinus sylvestris* (Diamandis 1985); on *Abies borisii-regis* (Avtzis & Diamandis 1988, Diamandis 1992)

Xeromphalina campanella (Batsh: Fr.) Kühner & Maire
Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); on *Picea abies* (Diamandis 1992)

Xerula radicata (Relh.: Fr.) Dörfelt
Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984)

Boletales
Boletaceae:
Boletus aereus Bull.: Fr.
in *Quercus conferta* (Diamandis 1983); Petroto (Evros) (Keltemlidis 1990); in *Fagus* sp. (Diamandis 1992)
Boletus amarellus Quél.
in *Pinus* sp. (Pantidou 1990)
Boletus appendiculatus Schaeff.: Fr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); in *Quercus conferta* (Diamandis 1985); in *Fagus* sp. and *Castanea sativa* (Diamandis 1992)
Boletus armeniacus Quél.
Attiki in *Pinus* sp. (Pantidou 1990)
Boletus calopus Fr.
in *Fagus* sp. (Maire & Politis 1940); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); Trikala (Korinthia) in conifers (Pantidou 1990); in *Quercus conferta* and *Fagus* sp. (Diamandis 1992)
Boletus edulis Bull.: Fr.
in *Abies cephalonica* (Landerer 1858); in *Abies cephalonica* (Maire & Politis 1940); (Pantidou 1973), Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); in *Fagus sylvatica* (Diamandis 1983), Hania (Magnesia) and Kakoskali (Mt. Ossa) in *Fagus sylvatica* (Pantidou & Gonou 1984); in *Quercus conferta* (Diamandis 1985); NPR of

Mt. Olympos and PF of Fracto (Drama) in *Fagus sylvatica* (Avtzis & Diamandis 1988); Kozani and Grevena (Keltemlidis 1990); in *Castanea sativa* (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)

Boletus erythropus (Fr.) Krombh.
in *Abies* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); in *Quercus conferta* (Diamandis 1983); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); (Pantidou 1990); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Boletus fragrans Vitt.
in *Quercus conferta* (Diamandis 1985)

Boletus impolitus Fr.
in *Quercus conferta* (Diamandis 1985); in *Castanea sativa* (Diamandis 1992); Andros in *Quercus* sp. (Lizon, pers. comm.)

Boletus luridus Schaeff.
in *Fagus sylvatica* and *Quercus* spp. (Diamandis 1985), NPR of Mt. Olympos in *Fagus sylvatica* (Avtzis & Diamandis 1988); in a *Cedrus libani* plantation and in *Fagus orientalis* (Diamandis 1992)

Boletus pinophilus Pil. & Dermek {= *Boletus pinicola* (Vitt.) Venturi}
Kozani and Grevena (Keltemlidis 1990); in *Fagus sylvestris* (Diamandis 1992)

Boletus purpureus Fr.
in *Castanea* sp. (Maire & Politis 1940)

Boletus queletii Schulzer
Attiki in *Pinus* sp. (Pantidou 1990); in *Quercus conferta* (Diamandis 1992)

Boletus regius Krombh.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Andros in *Sarcopoterium* sp., and *Cistus* sp. (Lizon, pers. comm.)

Boletus rubinellus Peck
in *Pinus halepensis* (Pantidou 1973); Attiki in *Pinus* sp. (Pantidou 1990)

Boletus satanas Lenz.
in *Quercus conferta* (Diamandis 1983)

Leccinum scabrum (Bull.: Fr.) S.F. Gray
Kefallonia in *Quercus* sp. (Pantidou 1990)

Chalciporus piperatus (Bull.: Fr.) Bat. {= *Boletus piperatus* Fr.}
in *Fagus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973); in *Pinus* sp. and *Abies* sp. (Pantidou 1990)

Suillus abietinus Pantidou & Watling
Vitina (Arkadia) in *Abies cephalonica* (Pantidou & Watling 1970); Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980)

Suillus alboflocculosus Watling & Pantidou
Roviais (Evoia) in *Pinus halepensis* (Pantidou & Watling 1970); Evoia in *Pinus* sp. (Pantidou 1990)

Suillus alkaliaurantians Pantidou & Watling

Varibombi (Attiki) in *Pinus halepensis* (Pantidou & Watling 1970); Attiki in *Pinus* sp. (Pantidou 1990)

Suillus bellinii (Inzenga) Watling

Dionisos (Attiki) in *Pinus halepensis* (Pantidou & Watling 1970); Attiki in *Pinus* sp. (Pantidou 1990); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Suillus boudieri (Quél.) Watling

Varibombi (Attiki) in *Pinus halepensis* (Pantidou & Watling 1970); Varibombi (Attiki) in *Pinus* sp. (Pantidou 1990)

Suillus bovinus (Fr.) Kuntze

in *Pinus brutia*, *P. halepensis* and *P. nigra* (Diamandis 1992); Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Suillus cembrae (Studer) Singer

in *Pinus halepensis* (Pantidou & Watling 1970); Mt. Parnitha (Attiki) in *Pinus* sp. (Pantidou 1990)

Suillus collinitus Fr. {= *Suillus fluryi* Huijsman}

Roviais (Evoia), Varibombi (Attiki) and Mt. Parnitha (Attiki) in *Pinus halepensis* (Pantidou & Watling 1970); Attiki in *Pinus* sp. (Pantidou 1990); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Suillus granulatus (Fr.) O. Kuntze

in *Pinus halepensis* and *P. nigra* (Maire & Politis 1940); Sarandapiho (Korinthia) in *Abies* sp. and *Pinus nigra* (Pantidou & Watling 1970); Attiki in *Pinus* sp. (Pantidou 1990); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica*, and Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Suillus luteus (L.: Fr.) S.F. Gray

in *Pinus nigra* (Maire & Politis 1940); in *Pinus sylvestris* (Diamandis 1985); in *Pinus nigra* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Suillus mediterraneensis (Jacq. & Blum) Redeuilh

Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Suillus obscurus Pantidou & Watling

Mt. Parnitha and Varibombi (Attiki), Atalanti (Fthiotida), Tripolis (Arkadia) and Akrokorinthos (Korinthia), in *Pinus halepensis* (Pantidou & Watling 1970); Attiki, Arkadia and Korinthia in *Pinus* sp. (Pantidou 1990)

Suillus plorans (Rolland) O. Kuntze

Ekali and Dionisos (Attiki) in *Pinus halepensis* (Pantidou & Watling 1970); Attiki in *Pinus* sp. forests (Pantidou 1990)

Suillus roseovelatus Pantidou & Watling

Thasos in *Pinus nigra* (Pantidou & Watling 1970); Thasos in *Pinus nigra* (Pantidou 1990)

Suillus variegatus (Fr.) Kuntze

in *Pinus nigra* (Diamandis 1985); in *Pinus sylvestris* (Diamandis 1992)

Tylopilus felleus (Bull.: Fr.) Karst.

Mt. Erymanthos (Korinthia) in *Abies* sp. (Pantidou 1990)

Xerocomus armeniacus (Fr.) Quél.

Thessaloniki in *Quercus coccifera* (Minter 1988)

Xerocomus badius (Fr.) Kühner: Gill.
in *Pinus* sp. (Pantidou 1973)

Xerocomus chrysenteron (Bull.) Quél. {= *Boletus chrysenteron* Bull.}
in *Pinus halepensis* and *P. nigra* (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984); in *Quercus conferta* (Diamandis 1985); Attiki in *Pinus* sp. and *Abies* sp. (Pantidou 1990); in *Pinus halepensis*, *P. nigra*, *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)

Xerocomus porosporus Imler {= *Boletus porosporus* (Imler) Watl.}
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); Attiki in *Abies* sp. (Pantidou 1990)

Xerocomus pulverulentus (Opat.) Gilb. {= *Boletus pulverulentus* Opat.}
in *Quercus conferta* (Diamandis 1992)

Xerocomus rubellus (Krombh.) Moser {= *Boletus versicolor* Rostk.}
in *Quercus pubescens* (Maire & Politis 1940); in *Pinus halepensis* (Diamandis 1992)

Xerocomus spadiceus (Fr.: Quél.) Quél.
in *Castanea* sp. (Maire & Politis 1940); Andros in *Quercus* sp. (Lizon, pers. comm.)

Xerocomus subtomentosus (L.: Fr.) Quél. {= *Boletus subtomentosus* Fr.}
in *Fagus* sp., *Pinus halepensis*, *Quercus frainetto* and *Q. macrolepis* (Maire & Politis 1940); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); Fthiotida in *Pinus* sp. and Evoia in *Quercus* sp. (Pantidou 1990); in *Picea abies* (Diamandis 1992)

Coniophoraceae:

Coniophora arida (Fr.) Karst.
Stavronikita Monastery (Agion Oros), Philotheou Monastery (Agion Oros) on *Castanea sativa*, Mt. Olympos on *Pinus nigra* and *P. leucodermis* (Minter 1988)

Coniophora puteana (Fr.) Karst.
Mt Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)

Leucogyrophana pseudomollusca (Parm.) Parm.
on *Abies borisii-regis* (Diamandis & Perlerou 1990); on *Abies borisii-regis* (Diamandis 1992); on *Abies cephalonica* (Diamandis & Perlerou 1994)

Serpula lacrymans Fr. {= *Merulius lacrymans* Fr.}
(Landerer 1858); Mt Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)

Gomphidiaceae:

Chroogomphus rutilus (Fr.) O.K. Miller {= *Gomphidius rutilus* (Schaeff.: Fr.) Lund. & Nannf.}
in *Abies* sp., *Pinus halepensis* and *P. nigra* (Maire & Politis 1940); Attiki in *Pinus* sp. (Pantidou 1990); in *Pinus halepensis*, *P. brutia*, *P. nigra*, *P. sylvestris* and *Abies* sp. (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, in mixed forests of *Pinus nigra* and *Abies cephalonica*, and in Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)

Gomphidius glutinosus (Schaeff.: Fr.) Fr.
in conifers (Maire & Politis 1940); Mt. Parnitha (Attiki), Chrisovitsi (Arkadia), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Pinus nigra* (Diamandis 1985); in *Pinus brutia*, *Picea abies* and *A. cephalonica* (Diamandis 1992)

Hygrophoropsidaceae:
Hygrophoropsis aurantiaca (Wulf.: Fr.) Maire
in *Pinus nigra* and *Picea abies* (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Paxillaceae:
Omphalotus olearius (DC.: Fr.) Singer {= *Pleurotus olearius* (DC.: Fr.) Gill.
= *Clitocybe olearia* (DC.: Fr.) Maire}
on *Olea europaea* and *Quercus coccifera* (Maire & Politis 1940); Kiphissia (Attiki) on *Olea europaea* (Sarejanni & Demetriades 1951); on *Olea europaea* (Pantidou 1990); on *Olea europaea* (Diamandis 1992); Andros in *Quercus* sp. (Lizon, pers. comm.); Kotsikia (Evoia) on *Olea europaea* (this work)

Paxillus atrotomentosus (Batsch.: Fr.) Fr.
(Pantidou 1990); in *Pinus sylvestris* (Diamandis 1992)
Paxillus involutus (Batsch.: Fr.) Fr.
in *Castanea* sp. and *Fagus* sp. (Maire & Politis 1940); Kiourka (Attiki) in *Pinus halepensis*, and in *Populus* sp. (Pantidou et al. 1983); Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); Attiki in *Pinus* sp. (Pantidou 1990); in *Castanea sativa* (Diamandis 1992); Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)

Paxillus panuoides Fr.
in *Pinus* sp. (Pantidou 1973); (Pantidou 1990); on *Abies borisii-regis* and *Pinus halepensis* (Diamandis 1992)

Rhizopogonaceae:
Rhizopogon aestivus Wul.: Fr.
in *Pinus halepensis* and *P. nigra* (Maire & Politis 1940)
Rhizopogon luteolus Fr.
in *Pinus nigra* (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Rhizopogon roseulus (Corda) Fr.
in *Pinus* sp. and *Abies* sp. (Pantidou 1990); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)

Cantharellales
Cantharellaceae:
Cantharellus cibarius Fr.

in *Quercus pubescens* (Maire & Politis 1940); in *Pinus* sp., *Abies* sp. and *Fagus* sp. (Pantidou 1973); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980); in *Fagus sylvatica* (Diamandis 1983); Pylos (Messinia), Chios (Keltemlidis 1990); in *Fagus orientalis*, *Quercus conferta*, *Q. pubescens* and *Picea abies* (Diamandis 1992); Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)

Cantharellus clavatus Fr.
in *Abies cephalonica* (Pantidou 1973)

Cantharellus ferruginascens Orton
(Diamandis 1985); in a mixed forest of *Fagus orientalis* and *Pinus nigra* (Diamandis 1992)

Cantharellus infundibuliformis (Scop.) Fr.
PF of Fracto (Drama) in *Pinus sylvestris* (Avtzis & Diamandis 1988)

Cantharellus lutescens Fr.
PF of Fracto (Drama) on *Picea abies* (Diamandis & Perlerou 1990); in mixed forests of *Fagus sylvatica*, *Pinus sylvestris*, *Picea abies* and *Abies borisii-regis* (Diamandis 1992)

Clavariaceae:

Clavaria acuta Fr.
NPR of Mt. Olympos among ferns (Diamandis & Perlerou 1990)

Clavaria fusiformis Sow.
(Diapoulis 1939)

Clavaria muscoides L.: Fr.
(Maire & Politis 1940)

Clavulinopsis subtilis (Fr.) Corner
in *Pinus nigra* (Diamandis 1992)

Clavariadelphaceae:

Clavariadelphus fistulosus (Fr.) Corner
on *Fagus sylvatica* (Diamandis 1985); on *Fagus sylvatica* (Diamandis & Perlerou 1990); on *Fagus orientalis* (Diamandis 1992)

Clavariadelphus junceus Fr.
(Diamandis 1985); in *Quercus* sp. (Diamandis 1992)

Clavariadelphus ligula (Fr.) Donk.
in *Abies borisii-regis* (Diamandis & Perlerou 1990); in *Abies borisii-regis* (Diamandis 1992); in *Abies cephalonica* (Diamandis & Perlerou 1994)

Clavariadelphus pistillaris (Fr.) Donk.
in *Quercus conferta* (Diamandis & Perlerou 1994); Gardiki and Mt. Oiti (Fthiotida) in *Abies* sp. (this work)

Clavariadelphus truncatus (Quél.) Donk
in conifers (Maire & Politis 1940); Mt. Parnitha (Attiki), Vitina (Arkadia), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Mt. Oiti (Fthiotida) in *Abies* sp. (this work)

Clavulinaceae:

Clavulina cinerea (Fr.) Schroet.
in mixed forests of *Carpinus betulus* and *A. borisii-regis*, and *Quercus conferta* and *Pinus nigra* (Diamandis 1992)
Clavulina cristata (Fr.) Schroet. {= *Clavaria cristata* Fr.}
in conifers and *Quercus* sp. (Maire & Politis 1940); (Diamandis 1985); in *Quercus* sp. and *Pinus brutia* (Diamandis 1992)
Clavulina rugosa (Fr.) Schroet. {= *Clavaria rugosa* Fr.}
(Heufler 1868); in *Pinus nigra* (Maire & Politis 1940); Mt Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Elati (Karditsa) (Minter 1988); in *Pinus brutia* (Diamandis & Perlerou 1990); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)

Craterellaceae:
Craterellus cornucopioides (L.: Fr.) Pers {= *Cantharellus cornucopioides* (L.: Fr.)}
in *Fagus* sp. (Diamandis 1992); in *Quercus conferta* (Diamandis & Perlerou 1994)

Hydnaceae:
Hydnum repandum L.: Fr.
in *Fagus* sp., *Castanea* sp. and *Pinus nigra* (Maire & Politis 1940); in *Fagus* sp. (Pantidou 1973); Mt. Parnitha (Attiki), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); on *Quercus conferta* (Diamandis 1983); Hania (Magnesia) in *Fagus sylvatica*, and Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); Mt. Olympos (Minter 1988); in *Abies cephalonica* and *Fagus* sp. (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia (Fthiotida) in *Fagus sylvatica*, and Gardiki (Fthiotida) in *Abies* sp. (this work)
Hydnum rufescens Fr.
Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); (Pantidou 1990); in *Fagus* sp., *Castanea sativa* and *Pinus nigra* (Diamandis 1992); Gardiki (Fthiotida) in *Abies* sp. (this work)

Scutigeraceae:
Albatrellus cristatus (Pers.) Kotl. & Pouzar {= *Polyporus cristatus* Pers.: Fr.}
in *Abies* sp. (Maire & Politis 1940); Milies (Magnesia) in *Castanea sativa* (Pantidou & Gonou 1984); NPR of Mt. Olympos in *Abies borisii-regis* (Diamandis & Perlerou 1990); in *Abies borisii-regis* (Diamandis 1992), NPR of Mt. Olympos in *Abies cephalonica* (Diamandis & Perlerou 1994)
Albatrellus pes-caprae (Pers.: Fr.) Pouzar
Hania (Magnesia) on *Fagus sylvatica* (Pantidou & Gonou 1984)
Albatrellus subrubescens (Murrill) Pouz.
in *Picea abies* (Diamandis 1992)

Sparassidaceae:
Sparassis crispa Wulf.: Fr.
NPR of Mt. Olympos in *Pinus nigra* (Diamandis & Perlerou 1990); in *Pinus sylvestris* (Diamandis 1992)

Typhulaceae:

Typhula erythropus Pers.: Fr.

(Diamandis 1985); in *Quercus conferta* (Diamandis 1992)

Fistulinales

Fistulinaceae:

Fistulina hepatica Schaeff.: Fr.

on *Castanea* sp. (Maire & Politis 1940); on *Quercus conferta*, *Q. pubescens* and *Castanea sativa* (Diamandis 1992); Gardiki (Fthiotida) on *Quercus* sp. (this work)

Ganodermatales

Ganodermataceae:

Ganoderma australe (Fr.) Pat. {= *Ganoderma adspersum* (Schulz.) Donk}

on *Abies cephalonica* (Petrak 1943); Lasithi plain (Crete) on *Quercus coccifera* and Heraklion (Crete) on *Ceratonia siliqua* (Plank 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Pertouli (Trikala) (Kailidis & Markalas 1981); PF of Fracto (Drama) on *Picea abies* (Avtzis & Diamandis 1988); on *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Litochoro (Pieria) on *Morus alba* and Nafplio (Argolis) on *Ligustrum lucidum* (Kotlaba & Klan 1994)

Ganoderma applanatum (Pers.) Pat.

on *Citrus* sp. (Sarejanni 1939); on *Platanus* sp. (Maire & Politis 1940); Pertouli (Trikala) (Kailidis & Markalas 1981); on *Fagus sylvatica* (Diamandis 1983); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Mt. Olympos on *Abies borisii-regis*, Elati (Karditsa) (Minter 1988); on *Fagus* spp. (Diamandis 1992); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)

Ganoderma carnosum Pat.

Elati (Karditsa) (Minter 1988); PF of Fracto (Drama) and Pertouli (Karditsa) on *Abies borisii-regis* (Diamandis & Perlerou 1990); on *Abies cephalonica* (Diamandis & Perlerou 1994)

Ganoderma pfeifferi Bres. {= *Ganoderma laccatum* (Kalchbr.) Bourd. & Galz.}

on *Quercus coccifera* (Petrak 1943)

Ganoderma lucidum (Curt.: Fr.) Karst.

on *Fraxinus excelsior*, *Quercus frainetto* and *Salix alba* (Maire & Politis 1940); Agrinio (Aitoloakarnania) on *Olea europaea* (Sarejanni & Demetriades 1951); Pertouli (Trikala) (Kailidis & Markalas 1981); on *Abies borisii-regis* (Diamandis 1985); NPR of Mt. Olympos on *Abies borisii-regis* (Avtzis & Diamandis 1988); Pantokratoros Monastery (Agion Oros) on *Quercus pubescens* (Minter 1988); on *Populus alba* (Diamandis & Perlerou 1990); on *Abies cephalonica* and *Pinus nigra* (Diamandis 1992); Olympia (Eleia) on *Populus nigra* (Kotlaba & Klan 1994)

Ganoderma resinaceum Boud.: Pat.

Karkalou (Arkadia) on *Salix* sp. (Kotlaba & Klan 1994)

Gomphales

Gomphaceae:

Gomphus clavatus (Fr.) Gray

Mt. Parnitha (Attiki), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)

Ramariaceae:

Ramaria aurea (Fr.) Quél.

in *Fagus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); NPR of Mt. Olympos and NPR of Pindos in *Pinus nigra* (Avtzis & Diamandis 1988); Ikaria (Keltemlidis 1990); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica*, Mt. Pilion (Magnesia) in *Fagus sylvatica*, Gardiki (Fthiotida) in *Abies* sp. (this work)

Ramaria botrytis (Fr.) Ricken

in *Abies borisii-regis* (Diamandis & Perlerou 1990); in *A. borisii-regis* (Diamandis 1992); in *Abies ceephalonica* (Diamandis & Perlerou 1994)

Ramaria flava (Fr.) Quél.

(Diamandis 1985); NPR of Mt. Olympos in *Pinus nigra* and *Abies borisii-regis* (Avtzis & Diamandis 1988); in *Abies cephalonica* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* and Mt. Pilion (Magnesia) in *Fagus sylvatica* (this work)

Ramaria flavobrunnescens (Akt.) Corner

in *Quercus conferta* (Diamandis 1992)

Ramaria formosa (Pers.: Fr.) Quél.

(Maire & Politis 1940)

Ramaria fumigata (Pk.) Corner

Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Gardiki (Fthiotida) in *Abies* sp. (this work)

Ramaria mairei Donk

in *Fagus* sp. (Maire & Politis 1940)

Ramaria myceliosa (Peck.) Corner

in *Pinus nigra* (Diamandis 1992)

Ramaria ochraceo-virens (Jungh.) Maire

(Maire & Politis 1940); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)

Ramaria pallida (Schaeff.: Schulzer) Ricken

in *Abies borisii-regis* (Diamandis & Perlerou 1990); in *Abies borisii-regis* (Diamandis 1992); in *Abies cephalonica* (Diamandis & Perlerou 1994)

Hericiales

Auriscalpiaceae:

Auriscalpium vulgare S.F. Gray

on *Pinus nigra* (Diamandis 1992); on *Pinus sylvestris* (Diamandis 1983)

Hericiaceae:

Hericium clathroides Pers.

on *Fagus sylvatica* (Diamandis 1983)

Hericium coralloides (Scop.: Fr.) Pers.

on *Abies borisii-regis* (Diamandis 1992)

Hericium erinaceus Pers.

on *Albizia julibrissin*, Crete on *Quercus* spp. and *Ceratonia siliqua*, Polygyros (Halkidiki) on *Quercus* spp., Aidonia and Kydonies (Grevena) on *Quercus pubescens*

(Keltemlidis 1990); on *Quercus conferta* (Diamandis 1992); (Diamandis & Perlerou 1994); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)

Laxitextum bicolor (Fr.) Lentz {= *Stereum bicolor* Fr.}
on *Fagus* sp. (Maire & Politis 1940)

Lentinellaceae:
Lentinellus cochleatus (Pres.: Fr.) Karst.
(Heufler 1868); Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1990)
Lentinellus flabelliformis (Bolt.: Fr.) Orton
Hania (Magnesia) on *Fagus sylvatica* (Pantidou & Gonou 1984)
Lentinellus ursinus (Fr.) Kühner
on *Abies cephalonica* (Maire & Politis 1940); Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1990), Gardiki (Fthiotida) on *Abies* sp. (this work)
Lentinellus vulpinus (Fr.) Kühner & Maire
on deciduous trees (Pantidou 1990)

Hymenochaetales
Hymenochaetaceae:
Coltricia perennis (L.: Fr.) Murr. {= *Polyporus perennis* L.: Fr.
= *Polyporus boucheanus* (Klotzsch.) Fr.
on *Pinus halepensis* (Maire & Politis 1940); on *Fagus sylvatica* (Pantidou 1973); Hania (Magnesia) on *Fagus sylvatica* (Pantidou & Gonou 1984)

Hymenochaete rubiginosa (Dicks.: Fr.) Lév.
on *Quercus conferta* (Diamandis 1983); Philotheou Monastery (Agion Oros) on *Castanea sativa*, Mt. Ossa (Larissa) on *Fagus sylvatica*, Kastanea on *Quercus* sp., Mt. Olympos on *Quercus pubescens*, and*Castanea sativa* (Minter 1988); on *Castanea sativa* (Diamandis 1992); Tsepelovon (Ioannina) on *Quercus* sp. (Kotlaba & Klan 1994); Mt. Oxia (Fthiotida) on *Fagus sylvatica* and Gardiki (Fthiotida) on *Abies* sp. (this work)

Inonotus hispidus (Bull.: Fr.) Karst.
on *Morus alba* and *Sophora japonica* (Sarejanni 1939); on *Morus alba*, *M. nigra*, *Quercus* sp. and *Sophora japonica* (Maire & Politis 1940); Rethimnon (Crete) on Morus sp. and Mesa Lasithi (Crete) on *Malus* spp. (Plank 1980); Stavrodromi (Ioannina) on *Morus alba* (Keltemlidis 1990)
Inonotus rickii (Pat.) Reid
Heraklion (Crete) on *Sambucus* sp. (Kotlaba & Klan 1994)
Inonotus tamaricis (Pat.) Maire {= *Polyporus tamaricis* (Pat.) Sacc.}
P. Faliron (Attiki) on *Tamarix* sp. (Maire & Politis 1940); Sidari (Corfu) and Agia Trias (Thessaloniki) on *Tamarix* sp. (Klan 1978); Heraklion, Platanias, Ierapetra, Sitia (Crete) on *Tamarix* (Plank 1980); on T*amarix* sp. (Diamandis 1992); Spetses on *Tamarix gallica* (Kotlaba & Klan 1994)

Onnia tomentosa (Fr.) Karst.
in *Pinus sylvestris* (Diamandis & Perlerou 1990)

Phellinus conchatus (Pers.: Fr.) Gill. {= *Fomes conchatus* (Pers.: Fr.) Gill.}
on *Castanea* sp. (Maire & Politis 1940)

Phellinus ferruginosus (Schrad.: Fr.) Pat.
Tsepelovon (Ioannina) on *Quercus* sp. (Kotlaba & Klan 1994)

Phellinus hartigii (All.: Schn.) Pat.
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Pertouli (Trikala), Mt. Parnitha (Attiki) and Karpenisi (Evritania) on *Abies* sp. (Kailidis & Markalas 1981); Mt. Olympos on *Abies borisii-regis*, Elati (Karditsa) on *Abies borissii-regis* (Minter 1988); on *Abies* spp. (Diamandis 1992); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)

Phellinus igniarius (L.: Fr.) Quél.
on *Fagus* sp. and *Quercus* sp. (Diapoulis 1939); on *Salix alba* (Maire & Politis 1940); on *Quercus* sp. (Petrak 1956); on *Salix alba*, *Fagus* sp. and *Quercus* sp. (Diamandis 1992)

Phellinus laevigatus (Fr.) Bourd. & Galz.
on *Quercus conferta* (Diamandis 1992)

Phellinus nigrolimitatus (Rom.) Bourd. & Galz.
Mt. Olympos on *Juniperus* sp. (Minter 1988)

Phellinus pini (Fr.) A. Ames {= *Polyporus pini* (Brot.: Fr.) Maire}
= *Fomes pini* (Thore: Fr.) Karst.
= *Trametes pini* (Brot.: Fr.) Fr.}
on *Pinus halepensis* (Sarejanni 1939); on *Pinus halepensis* (Maire & Politis 1940); (Petrak 1943); on *Pinus halepensis* (Kailidis 1962); on *Pinus halepensis*, *P. brutia* and *P. nigra* (Diamandis 1992); NPR of Samaria (Crete) on *Pinus brutia* (Diamandis & Perlerou 1994]; Olympia (Eleia), Epidavros (Argolis) and Athens (Attiki) on *Pinus halepensis* (Kotlaba & Klan 1994)

Phellinus pomaceus (Pers.) Maire {= *Fomes pomaceus* (Pers.) Big. & Guill.
= *Phellinus tuberculosus* (Baumg.) Niemelä}
on *Prunus dulcis* (Sarejanni 1939); Tripoli (Arkadia) on *Prunus avium* (Pantidou 1973); Lasithi Plain, Platanias, Skines, Omalos, Drassi (Crete) on *Amygdalus communis* (Plank 1980); Mt. Olympos on *Prunus domestica* (Minter 1988); on *Amygdalus communis* (Diamandis 1992); Katerini (Pieria) on *Prunus domestica*, Hydra on *Amygdalus communis*, Spetses on *Prunus domestica*, and Mykenai (Argolis) on *Amygdalus communis* (Kotlaba & Klan 1994)

Phellinus punctatus (Fr.) Pilát
Elias mountain (Rhodos) on *Ulmus* sp. and Ano near Spili (Crete) on *Olea europaea* (Plank 1980); Tolo (Argolis) on *Olea europaea* (Kotlaba & Klan 1994)

Phellinus rimosus (Berk.) Pilát {= *Fomes rimosus* (Berk.) Cooke}
Chios on *Pistacia lentiscus* var. *chia* (Sarejanni & Demetriades 1951); Hydra on *Pistacia vera* (Sarejanni et al. 1954); Corfu on *Robinia pseudoacacia* (Kotlaba & Pouzar 1978); Mt. Smith (Rhodos) on *Pistacia* cf. *terebinthus* (Plank 1980)

Phellinus robustus(Karst.) Bourd. & Galz. {= *Fomes robustus* Karst.}
on *Citrus sinensis* (Sarejanni 1939); on *Abies* sp. and *Quercus coccifera* (Maire & Politis 1940); on *Populus* sp. (Diamandis 1992); Mt. Pilion (Magnesia) on *Fagus sylvatica* (this work)

Phellinus torulosus Pers. {= *Fomes torulosus* (Pers.) Lloyd} on *Arbutus unedo* and *Crataegus heldreichii* (Maire & Politis 1940); Ano near Spili (Crete) on *Olea europaea*, Ierapetra (Crete) on *Ceratonia siliqua* and Mesa Lasithi (Crete) on *Prunus dulcis* (Plank 1980); Philotheou Monastery (Agion Oros) on *Castanea sativa*, Iberon Monastery (Agion Oros) on *Quercus ilex*, Kastanea on *Quercus* sp., Mt. Ossa (Larissa) on *Castanea* sp., Mt. Olympos on *Arbutus unedo* (Minter 1988); on *Castanea sativa* (Diamandis 1992)

Lycoperdales

Geastraceae:

Geastrum coronatum Pers.: Pers.
(Maire & Politis 1940)

Geastrum fimbriatum Fr. {= *Geastrum sessile* (Sow.) Pouz.}
(Maire & Politis 1940); Mt. Olympos in *Pinus* sp., and *Quercus* sp. (Minter 1988); Attiki in *Abies* sp. (Pantidou 1990); in *A. borisii-regis* (Diamandis 1992)

Geastrum pectinatum Pers.
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Andros in *Cupressus sempervirens* (Lizon, pers. comm.)

Geastrum rufescens Pers.: Pers
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)

Geastrum triplex Jungh.
Mt. Parnitha (Attiki), Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); in mixed forests of *Pinus nigra* and *Fagus sylvatica* (Diamandis 1985); NPR of Mt. Olympos in *Pinus nigra* (Avtzis & Diamandis 1988); in mixed forests of *Pinus nigra*, *A. borisii-regis* and *Fagus* sp. (Diamandis 1992); Andros in *Cupressus sempervirens* (Lizon, pers. comm.)

Myriostoma coliformis (With.: Pers.) Corda
in *A. borisii-regis* (Diamandis 1992)

Lycoperdaceae:

Bovista dermoxantha (Vittad.) De Toni {= *Bovista pusilla* (Batsch: Pers.) Pers.}
Vasssilika (Thessaloniki) (Minter 1988)

Bovista graveolens
Kastanea in *Abies* sp., Elati (Karditsa) in *Abies* sp. (Minter 1988)

Bovista nigrescens Pers.: Pers.
(Diapoulis 1939); Elati (Karditsa) (Minter 1988); in *Quercus conferta* (Diamandis 1992)

Bovista plumbea Pers.: Pers.
(Heufler 1868); (Maire & Politis 1940); (Diamandis 1985); Mt. Olympos, Elati (Karditsa) (Minter 1988); in *Quercus conferta* and *Pinus brutia* (Diamandis 1992)

Bovistella radicata (Dur. & Mont.) Pat.
Kastanea in *Abies* sp. (Minter 1988); Mt. Taygetos (Peloponnese) (Pantidou 1990)

Calvatia cyathiformis (Bosc.) Morg.
(Maire & Politis 1940)

Calvatia gigantea (Batsch: Pers.) Lloyd {= *Langermannia gigantea* (Batsch: Pers.) Rostk.}
(Maire & Politis 1940); (Diamandis 1992)
Calvatia pachyderma (Peck) Morgan
(Petrak 1943)

Handkea excipuliformis (Pers.: Pers.) Kreisel {= *Calvatia excipuliformis* (Pers.) Perdek
= *Lycoperdon excipuliformis* Schaeff.: Pers.
= *Calvatia saccata* (Vahl) Lloyd}
(Maire & Politis 1940); (Petrak 1943); Vassilika (Thessaloniki) in *Pinus* sp. (Minter 1988); (Keltemlidis 1990); Attiki in *Abies* sp. (Pantidou 1990); in fields (Diamandis 1992)
Handkea utriformis (Bull.: Pers.) Kreisel {= *Calvatia utriformis* (Bull.: Pers.) Jaap
= *Calvatia bovista* (Pers.) Fr.}
(Maire & Politis 1940); in fields (Diamandis 1992)

Lycoperdon atropurpureum Vittad.
Vassilika (Thessaloniki), Mt. Olympos in *Abies* sp. and in *Castanea* sp. (Minter 1988); Dirfi (Evoia) in *Abies* sp. (Pantidou 1990)
Lycoperdon echinatum Pers.
NPR of Mt. Olympos in *Fagus sylvatica* (Diamandis & Perlerou 1990); in *Fagus orientalis* (Diamandis 1992)
Lycoperdon lambinonii Demoulin
Iberon Monastery (Agion Oros), Mt. Olympos in *Abies* sp. (Minter 1988)
Lycoperdon lividum Pers. {= *Lycoperdon spadiceum* Pers.}
(Diamandis 1985); in fields (Diamandis 1992)
Lycoperdon molle Pers.: Pers.
Vassilika (Thessaloniki) (Minter 1988)
Lycoperdon nigrescens Pers. {= *Lycoperdon foetidum* Bonord.}
Meteora (Trikala) in *Quercus coccifera*, Kastanea, and Elati (Karditsa) in *Abies* sp. (Minter 1988)
Lycoperdon perlatum Pers.: Pers.
in *Castanea* sp. and *Fagus* sp. (Maire & Politis 1940); in *Pinus halepensis* (Pantidou 1973); Mt. Parnitha (Attiki), Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Hania (Magnesia) in *Fagus sylvatica* [Pantidou 1973, (Pantidou & Gonou 1984); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); NPR of Mt. Olympos in *Abies borisii-regis* and PF of Fracto (Drama) in *Picea abies* (Avtzis & Diamandis 1988); Iberon Monastery (Agion Oros), Kastanea in *Abies* sp., and in *Quercus* sp., Elati (Karditsa) in *Abies* sp., Mt. Olympos in *Pinus* sp., and *Quercus* sp. (Minter 1988); (Keltemlidis 1990); (Pantidou 1990); in *Abies cephalonica, Pinus nigra*, *P. brutia* and *P. sylvestris* (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia (Fthiotida) in *Fagus sylvatica*, Mt. Pilion (Magnesia) in *Fagus sylvatica* and Gardiki (Fthiotida) in *Abies* sp. (this work)
Lycoperdon pyriforme Schaeff.: Pers.
in *Castanea* sp. (Maire & Politis 1940); NPR of Pindos in *Pinus nigra* and PF of Fracto (Drama) in *Fagus sylvatica* (Avtzis & Diamandis 1988); Kastanea in *Abies* sp., and

Quercus sp., Elati (Karditsa) in *Abies* sp., Mt. Olympos in *Quercus* sp. (Minter 1988); in *Castanea sativa* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)

Vascellum pratense (Pers.: Pers.) Kreisel {= *Lycoperdon pratense* Pers.}
(Maire & Politis 1940); Kastanea in *Abies* sp., Mt. Olympos (Minter 1988) (Minter 1988); NPR of Mt. Olympos on pasture land (Diamandis & Perlerou 1990)

Nidulariales
Nidulariaceae:
Crucibulum laeve (Huds.) Kam.
on *Pinus sylvestris* (Diamandis 1985); Kastanea on *Abies borissi-regis*, Elati (Karditsa) on *Abies borisii-regis* (Minter 1988); on *Pteridium aquilinum* and *Quercus conferta* (Diamandis & Perlerou 1990); on *Abies cephalonica* and *Platanus orientalis* (Diamandis 1992)

Cyathus alba Pers.
(Heufler 1868); (Maire & Politis 1940)
Cyathus campanulatus Pers.
(Heufler 1868)
Cyathus olla (Batsch.: Pers.) Pers.
(Diamandis 1983); on *Pirus communis* (Diamandis 1992)
Cyathus stercoreus (Schw.) de Toni
NPR of Mt. Olympos (Diamandis & Perlerou 1990)
Cyathus striatus (Huds.) Pers.
on *Fagus sylvatica* (Diamandis & Perlerou 1990); on *Fagus orientalis* (Diamandis 1992)

Phallales
Clathraceae:
Clathrus ruber Pers.
(Diamandis 1992); Andros in *Quercus* sp. (Lizon, pers. comm.)

Phallaceae:
Mutinus caninus (Huds.: Pers.) Fr.
in *Fagus orientalis* (Diamandis & Perlerou 1990)

Phallus impudicus Pers.
(Landerer 1858); Mt. Pilion (Magnesia) in *Castanea sativa* (Pantidou 1990); in *Quercus conferta*, *Fagus* sp. and *Castanea sativa* (Diamandis 1992); Andros in *Vitis vinifera* (Lizon, pers. comm.)

Poriales
Coriolaceae:
Abortiporus biennis (Bull.: Fr.) Sing. {= *Heteroporus biennis* (Bull.: Fr.) Laz.}
on *Pinus* sp. (Pantidou 1973, Pantidou 1990); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983)

Antrodia albida (Fr.: Fr.) Donk
Stavronikita Monastery (Agion Oros) on *Myrtus* sp. (Minter 1988)
Antrodia heteromorpha (Fr.) Donk
Georgioupoli (Crete) on *Cupressus sempervirens* (Plank 1980)
Antrodia ramentacea (Berk. & Br.) Donk
Mt. Olympos on *Pinus* sp. (Minter 1988)
Antrodia serialis (Fr.) Donk {=*Coriolus serialis* Fr.}
Kalambaka on *Abies* spp. (Diamandis 1983); PF of Fracto (Drama) on *Picea abies* (Diamandis & Perlerou 1990); on *Picea abies* (Diamandis 1992)
Antrodia vaillantii (Fr.) Ryv.
City of Rhodos (Rhodos) on *Pinus* spp. (Plank 1980)

Aurantioporus croceus (Pers.: Fr.) Murrill
on *Fagus* sp. (Diamandis 1992); PF of Fracto (Drama) on *Picea abies* (Avtzis & Diamandis 1988); PF of Fracto (Drama) on *Picea abies* (Diamandis & Perlerou 1990)

Bjerkandera adusta (Willd.: Fr.) Karst.
on *Abies* sp. (Maire & Politis 1940); NPR of Mt. Olympos, NPR of Pindos, PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Mt. Ossa (Larissa) on *Fagus sylvatica* (Minter 1988); on *Fagus* spp. (Diamandis 1992); Nafplio (Argolis) on *Acacia retinodes* (Kotlaba & Klan 1994)

Ceriporiopsis gilvescens (Bres.) Dom.
NPR of Samaria (Crete) on *Pinus brutia* (Diamandis & Perlerou 1990)
Ceriporiopsis mucida (Pers.: Fr.) Gilbn. & Ryv. {= *Porpomyces mucidus* (Pers.: Fr.) Jül.}
PF of Fracto (Drama) on *Picea abies* (Diamandis & Perlerou 1990)

Cerrena unicolor (Fr.) Murr. {= *Coriolus unicolor* (Bull.: Fr.) Pilát}
Mesa Lasithi (Crete) on *Prunus dulcis* (Plank 1980); Mt. Olympos in *Fagus sylvatica* (Minter 1988); Katerini (Pieria) on *Fagus sylvatica* (Kotlaba & Klan 1994)

Climacocystis borealis (Fr.) Kotl. & Pouz.
PF of Fracto (Drama) on *Picea abies* (Diamandis & Perlerou 1990)

Coriolopsis gallica (Fr.) Ryv. {= *Trametes hispida* Bagl.}
on *Castanea* sp., *Salix alba* and *Quercus macrolepis* (Maire & Politis 1940); on *Platanus orientalis* (Petrak 1943); Palekastro (Crete) on *Olea europaea* (Plank 1980)

Fomes fomentarius (L.: Fr.) Kickx.
on *Fagus* sp. (Diapoulis 1939); on *Fagus* sp., *Platanus* sp. and *Populus alba* (Maire & Politis 1940); on *Fagus* sp. (Kailidis 1962); Souda (Crete) on *Platanus orientalis* (Plank 1980); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Mt. Olympos on *Fagus sylvatica*, Mt. Ossa (Larissa) on *Fagus sylvatica* (Minter 1988); on *Betula* sp. (Diamandis 1992); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)

Fomitopsis officinalis (Vill.: Fr.) Faull. {= *Fomes officinalis* (Vill.: Fr.) Faull.}
(Landerer 1858)
Fomitopsis pinicola (Sow.: Fr.) Karst.
on *Abies* sp. (Maire & Politis 1940); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Pertouli (Trikala) (Kailidis & Markalas 1981); NPR of Mt. Olympos on *Abies borisii-regis* and PF of Fracto (Drama) on *Picea abies* (Avtzis & Diamandis 1988); Mt. Olympos on *Abies appolonis*, Elati (Karditsa) on *Abies borissii-regis* (Minter 1988); on *Abies cephalonica* (Diamandis 1992)

Gloeophyllum abietinum Fr.: Fr.
(Rechinger 1914); on *Cupressus sempervirens* (Maire & Politis 1940); (Petrak 1943); Pertouli (Trikala) on *Abies borisii-regis* (Kailidis & Markalas 1981); Elati (Karditsa) on *Abies borissii-regis* (Minter 1988); on *Pinus brutia* (Diamandis & Perlerou 1990); on *Pinus brutia* and *Cupressus* sp. (Diamandis 1992); Hydra on *Cupressus sempervirens* (Kotlaba & Klan 1994)
Gloeophyllum sepiarium (Wulf.: Fr.) Karst. {= *Lenzites sepiaria* Fr.}
on *Abies* sp. and *Pinus nigra* (Maire & Politis 1940); on *Cupressus sempervirens* (Petrak 1943); on *Abies* sp. (Kailidis & Markalas 1981); Mt. Mainalon (Arkadia) on *Abies cephalonica* (Diamandis & Minter 1981); Elati (Karditsa) on *Abies* sp. (Minter 1988); Crete on *Cupressus* sp. (Pantidou 1990); on *Abies cephalonica*, *A. borisii-regis* and *Picea abies* (Diamandis 1992); Gardiki and Oiti (Fthiotida) on *Abies* sp. (this work)
Gloeophyllum trabeum (Fr.) Murr.
Alonissos on *Pinus halepensis* (Plank 1980)

Grifola frondosa (Dicks.: Fr.) S.F. Gray
Mt. Pilion (Magnesia) on *Fagus sylvatica* (this work)

Hapalopilus nidulans (Fr.) Karst. {= *Hapalopilus rutilans* (Pers.: Fr.) Karst.}
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Meteora (Trikala), Mt. Ossa (Larissa) (Minter 1988); on *Quercus conferta*, *Fagus* sp. and *Abies cephalonica* (Diamandis 1992); Tsepelovon (Ioannina) on *Quercus* sp. (Kotlaba & Klan 1994)

Heterobasidion annosum (Fr.) Bref.
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); NPR of Mt. Olympos on *Abies borisii-regis* and PF of Fracto (Drama) on *Picea abies* (Avtzis & Diamandis 1988); Elati (Karditsa) on *Abies borissii-regis* (Minter 1988); on *Abies cephalonica* (Diamandis 1992)

Hexagonia nitida Dur. & Mont {= *Apoxona nitida* (Dur. & Mont) Donk}
Samaria gorge (Crete) on *Quercus coccifera* and Armenia (Crete) on *Quercus macrolepis* (Plank 1980)

Ischnoderma benzoinum (Wahl.: Fr.) Karst. {= *Polyporus benzoinus* Fr.}

on *Abies cephalonica* (Pantidou 1973); Pertouli (Trikala) on *Abies* sp. (Kailidis & Markalas 1981); on *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997); Gardiki (Fthiotida) on *Abies* sp. (this work)

Ischnoderma resinosum (Fr.) Karst.

Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); on *Abies borisii-regis* (Diamandis 1985); NPR of Mt. Olympos on *Abies borisii-regis* and PF of Fracto (Drama) on *Picea abies* and *Abies borisii-regis* (Avtzis & Diamandis 1988); on *Fagus* spp. (Diamandis 1992)

Laetiporus sulphureus (Bull.: Fr.) Murr. {= *Polyporus sulphureus* Bull.: Fr.}

on *Castanea* sp., *Cedrus libani*, *Populus alba*, *Prunus armeniaca* and *Quercus ilex* (Maire & Politis 1940); (Petrak 1943); on *Salix* sp. (Kailidis 1962); Mt. Olympos on *Castanea sativa* (Minter 1988); (Pantidou 1990); on *Castanea sativa* and *Populus* sp. (Diamandis 1992); Nafplio (Argolis) on *Eucalyptus camaldulensis* (Kotlaba & Klan 1994); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)

Lenzites betulinus (L.: Fr.) Fr.

on *Castanea* sp. (Maire & Politis 1940); on *Castanea sativa*, *Ulmus pediata*, and *Quercus conferta* (Diamandis 1992)

Meripilus giganteus (Pers.: Fr.) Karst. {= *Polyporus giganteus* Pers.: Fr.}

on *Fagus* sp. (Maire & Politis 1940); on *Salix alba* and *Quercus conferta* (Diamandis 1992)

Oligoporus balsameus (Peck) Gilb. & Ryv. {= *Tyromyces balsameus* (Peck) Murrill}

Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1980)

Oligoporus caesius (Schrad.: Fr.) Gilb. & Ryv. {= *Postia caesia* (Schrad.: Fr.) Karst.,
= *Tyromyces caesius* (Schraed.: Fr.) Murr.,
= *Polyporus caesius* Schrad.: Fr.}

on *Abies* sp. (Maire & Politis 1940); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); on *Abies cephalonica*, *A. borisii-regis* and *Fagus* sp. (Diamandis 1992); Mt. Pilion (Magnesia) on *Fagus sylvatica* (this work)

Oligoporus rennyi (Berk. & Br.) Donk

PF of Fracto (Drama) on *Picea abies* (Avtzis & Diamandis 1988)

Oligoporus stipticus (Pers.: Fr.) Gilb. & Ryv. {= *Postia stiptica* (Pers.: Fr.) Jül.,
=*Tyromyces stipticus* (Pers.: Fr.) Kotl. & Pouz.}

on *Pinus brutia* (Diamandis & Perlerou 1990)

Perenniporia ochroleuca (Berk.) Ryv.

Agion Oros on *Quercus ilex* (Minter 1988)

Perenniporia tenuis (Schw.) Ryv.

Tolo (Argolis) on *Vitis vinifera* and *Bougainvillea glabra*, and Hydra on *Phlomis fruticosa* (Kotlaba & Klan 1994)

Phaeolus schweinitzii (Fr.) Pat.

on *Pinus sylvestris* and *Abies borisii-regis* (Diamandis & Perlerou 1990); on *Pinus halepensis* (Diamandis 1992); PF of Fracto (Drama) on *Pinus sylvestris* (Diamandis & Perlerou 1994)

Piptoporus betulinus (Bull.: Fr.) Karst.
on *Betula* spp. (Diamandis 1983); PF of Fracto (Drama) on *Betula* spp. (Avtzis & Diamandis 1988)

Pycnoporus cinnabarinus (Jacq.: Fr.) Karst. {= *Polyporus cinnabarinus* Jacq.: Fr.}
(Avtzis & Diamandis 1988); PF of Fracto (Drama) on *Picea abies* (Diamandis & Perlerou 1990); on *Fagus orientalis* (Diamandis 1992)

Rigidoporus sanguinolentus (A. & S.: Fr.) Donk
on *Fagus sylvatica* (Diamandis 1985)
Rigidoporus ulmarius (Sow.: Fr.) Imazeki
Mt. Olympos on *Ulmus* sp., Dion (Pella) (Minter 1988); on *Ulmus pediata* (Diamandis 1992)

Skeletocutis carneogrisea David
NPR of Mt. Olympos on *Pinus nigra* (Diamandis & Perlerou 1990)
Skeletocutis nivea (Jungh.) Keller
Mt. Ossa (Larissa) on *Tilia* sp. (Minter 1988)
Skeletocutis percandida (Malencon & Bertault) Keller
Mt. Olympos on *Castanea* sp. (Minter 1988)

Trametes gibbosa (Pers.) Fr. {= *Pseudotrametes gibbosa* (Pers.) Bond. & Sing.}
on *Fagus sylvatica* (Diamandis 1983); on *Fagus* spp. (Diamandis 1992); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)
Trametes hirsutus (Wulf.: Fr.) Quél. {= *Coriolus hirsutus* (Wulf.: Fr.) Quél.}
on *Olea europaea* (Rechinger 1914); on *Castanea* sp. (Maire & Politis 1940); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Mt. Olympos on *Pinus nigra* (Minter 1988); on *Fagus* spp. (Diamandis 1992)
Trametes versicolor (L.: Fr.) Pilát {= *Coriolus versicolor* (L.: Fr.) Quél.}
on *Citrus* sp. and *Laurus nobilis* (Sarejanni 1939); on *Abies* sp. (Maire & Politis 1940); on *Liquidambar* sp. (Petrak 1943); on *Quercus* sp. (Pantidou 1973); Georgioupoli (Crete) on *Cupressus sempervirens* (Plank 1980), Pertouli (Trikala) (Kailidis & Markalas 1981); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Meteora (Trikala) on *Quercus coccifera*, Kastanea on *Quercus pubescens*, Mt. Olympos on dead wood, and on *Castanea sativa*, Mt. Ossa (Larissa) on *Fagus sylvatica* (Minter 1988); on *Quercus* sp. and *Pyrus communis* (Pantidou 1990); on *Quercus* sp. and *A. borisii-regis* (Diamandis 1992); Tsepelovon (Ioannina) on *Quercus* sp. and Nafplion (Argolis) on *Acacia retinodes* (Kotlaba & Klan 1994); Mt. Oxia (Fthiotida) on *Fagus sylvatica* and Gardiki (Fthiotida) on *Abies* sp. (this work)
Trametes trogii Berk. {= *Coriolus trogii* Berk.}

Elasson (Larissa) on *Populus* (Plank 1980)

Trichaptum abietinus (Dicks: Fr.) Ryv. {= *Hirschioporus abietinus* (Dicks: Fr.) Donk,
= *Polyporus abietinus* (Dicks.: Fries}
Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); Pertouli (Trikala) on *Abies borisii-regis* and Mt. Parnitha (Attiki) on *Abies cephalonic*a (Kailidis & Markalas 1981); on *Pinus brutia* (Diamandis 1985); NPR of Mt. Olympos on *Abies borisii-regis* and on *Pinus nigra*, NPR of Pindos on *Pinus nigra* and PF of Fracto (Drama) on *Picea abies* and on *Abies borisii-regis* (Avtzis & Diamandis 1988); Mt. Olympos on *Abies* sp., Kastanea on *Abies* sp., Elati (Karditsa) on *Abies borisii-regis* and *A. appolonis* (Minter 1988); on *Abies cephalonica* (Diamandis 1992)
Trichaptum biforme (Fr.) Ryv. {= *Polyporus pargamenus* Fr.}
on *Fagus* sp. (Maire & Politis 1940)
Trichaptum fuscoviolaceum (Ehrenb.: Fr.) Ryv.
NPR of Mt. Olympos on *Pinus nigra* (Diamandis & Perlerou 1990); on *Pinus nigra* (Diamandis & Perlerou 1994)

Truncospora ochroleuca
Iberon Monastery (Agion Oros) on *Quercus ilex* (Minter 1988)

Lentinaceae:
Lentinus lepideus (Fr.: Fr.) Fr.
on *Pinus leucodermis* (Diamandis 1985), NPR of Mt. Olympos on *Pinus leucodermis* (Avtzis & Diamandis 1988); Polychrono (Halkidiki) on *Ficus carica* (Pantidou 1990); Mt. Pilion (Magnesia) on *Fagus sylvatica* (this work)
Lentinus tigrinus (Bull.: Fr.) Fr.
(Heufler 1868); on *Castanea sativa* (Diamandis 1992)
Lentinus ursinus Fr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)

Panus rudis Fr.
on *Juniperus foetidissima* (Maire & Politis 1940)

Phyllotopsis nidulans (Pers.: Fr.) Singer
Pertouli (Trikala) (Kailidis & Markalas 1981); Mt. Ossa (Larissa) on *Fagus sylvatica* (Pantidou 1990); Gardiki (Fthiotida) on *Abies* sp. (this work)

Pleurotus cornucopiae (Paul.: Pers.) Roll.
on *Olea europaea* (Maire & Politis 1940); on *Quercus conferta* (Diamandis 1992)
Pleurotus cystidiosus O.K. Miller
Salamina (Pireus) on *Ficus carica* (Zervakis et al. 1992)
Pleurotus eryngii (DC.: Fr.) Quél.
Eryngium amethystinum, *E. campestre* and *Ferula* sp. (Maire & Politis 1940); Skalohori and Thermi (Lesvos), Crete on *Ferula communis* and Samos on *Eryngium campestre* (Keltemlidis 1990); (Pantidou 1990) Kroustas (Crete) on *Eryngium*

campestre and Orestiada (Evros) on *Ferula communis* (Zervakis & Balis 1991); Andros on *Eryngium campestre* and *Ferula communis* (Zervakis & Balis 1996)

Pleurotus ostreatus (Jacq.: Fr.) Kummer {= *P. salignus* (Schrad.: Fr.) Quél.
= *P. spodoleucus* Fr.}

on *Fagus* sp. (Heufler 1868); on *Ailanthus altissima*, *Olea europaea*, *Fagus* sp. and *Quercus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1980); Pertouli (Trikala) (Kailidis & Markalas 1981); Elati (Karditsa) on *Abies* sp. (Minter 1988); Attiki on *Abies* sp. and *Pinus* sp. (Pantidou 1990); Samos and Lesvos on *Populus nigra*, Ano Tarsos (Korinthia), Platanos (Arkadia), Damaskinia (Kozani), Vamvakou and Vresthena (Lakonia) (Keltemlidis 1990); Mt. Oxia (Fthiotida) on *Fagus sylvatica*, Fteri (Fthiotida) and Orestiada (Evros) on *Populus* sp. (Zervakis & Balis 1991); on *Fagus* sp., *Populus* sp., *Abies cephalonica* and *A. borisii-regis*, and Mt. Mainalon on *Abies* spp. (Diamandis 1992); Mt. Parnitha (Attiki) and Mt. Dirfi (Evoia) on *Abies cephalonica*, Tripoli (Arkadia) on *Castanea sativa* and Mt. Chelmos (Peloponnese) on *Salix* sp. (Zervakis & Balis 1996); Kastoria and Larissa on *Fagus sylvatica* (this work)

Pleurotus pulmonarius (Fr.) Quél.

Mt. Oxia (Fthiotida) on *Fagus sylvatica* (Zervakis & Balis 1991) Rodopi on *Fagus sylvatica* (Zervakis & Balis 1996)

Polyporaceae:

Daedalea quercina L.: Fr.

Dion (Pella) on *Quercus* sp., Mt. Ossa (Larissa) on *Quercus* sp. (Minter 1988)

Datronia mollis (Sommerf.: Fr.) Donk

Kastanea, Mt. Ossa (Larissa) on *Tilia* sp. (Minter 1988)

Dichomitus campestris (Quél.) Doman. & Orlicz

Armenia (Crete) on *Quercus macrolepis* (Plank 1980); on *Fagus sylvatica* (Diamandis 1985); Meteora (Trikala) on *Quercus* sp., and Mt. Olympos on *Quercus ilex* (Minter 1988); Tsepelovon (Ioannina) on *Quercus* sp. (Kotlaba & Klan 1994)

Gloeoporus dichrous (Fr.: Fr.) Bres. {= *Caloporus dichrous* (Fr.) Ryv.}

Lasithi plain (Crete), on *Prunus dulcis* and on basidiomata of *Phellinus pomaceus* (Plank 1980); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); Mt. Olympos (Minter 1988)

Junghuhnia nitida (Pers.: Fr.) Ryv.

Mt. Ossa (Larissa) on *Fagus sylvatica*, Mt. Olympos on *Abies* sp., *Castanea sativa* (Minter 1988)

Polyporus arcularius Batsch: Fr.

on *Fagus* sp. (Maire & Politis 1940); (Petrak 1943); on *Quercus conferta* (Diamandis 1992); Tsepelovon (Ioannina) on *Quercus* sp. (Kotlaba & Klan 1994); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)

Polyporus brumalis Pers.: Fr.

on *Fagus sylvatica* (Diamandis 1992); Gardiki (Fthiotida) on *Quercus* sp. (this work)

Polyporus ciliatus Fr.: Fr.
on *Fagus sylvatica* (Diamandis 1985)
Polyporus squamosus Huds.: Fr.
on *Juglans regia* (Sarejanni 1939); Edessa (Pella) on *Juglans regia* (Sarejanni & Demetriades 1951); PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Kastoria on deciduous trees (Pantidou 1990); on *Fagus orientalis* (Diamandis 1992)
Polyporus tuberaster Jacq.: Fr. {= *Polyporus lentus* Berk.}
on *Fagus orientalis* (Diamandis 1992)
Polyporus varius Pers.: Fr.
on *Fagus sylvatica* (Diamandis 1985); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Katerini (Pieria) on *Fagus sylvatica* (Kotlaba & Klan 1994)

Spongipellis pachyodon (Pers.) Kotl. & Pouz.
Kastanea on *Quercus* sp. (this work)

Russulales
Russulaceae:
Lactarius azonites (Bull.) Fr.
in *Quercus conferta* (Diamandis & Perlerou 1994)
Lactarius blennius (Fr.: Fr.) Fr.
Hania (Magnesia) in *Fagus sylvatica* (Pantidou 1973, Pantidou & Gonou 1984); in *Fagus orientalis* and *F. sylvatica* (Diamandis 1992); in *Quercus conferta* (Diamandis & Perlerou 1994); Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Lactarius chrysorrheus Fr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980), in *Quercus conferta* (Diamandis 1983); in *Quercus coccifera* and *Abies cephalonica* (Diamandis 1992); Milies (Magnesia) in *Castana sativa* (Pantidou & Gonou 1984); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)
Lactarius circellatus Fr.
in a *Quercus conferta* and *Pinus nigra* (Diamandis 1992), in *Quercus conferta* (Diamandis & Perlerou 1994); Mt. Oxia (Fthiotida) in *Fagus sylvatica* (this work)
Lactarius controversus (Pers.: Fr.)
in *Populus* sp. (Maire & Politis 1940); Hania (Magnesia) in *Fagus sylvatica* [Pantidou 1973, (Pantidou & Gonou 1984); in a *Populus* sp. plantation (Diamandis 1992)
Lactarius deliciosus (L.: Fr.) S.F. Gray
in *Fagus* sp. and *Quercus* sp. (Diapoulis 1939), in *Abies* sp. and *Pinus* sp. (Maire & Politis 1940); in *Pinus halepensis* (Pantidou 1973); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Crete, Ayiasos (Lesvos), Chios in *Cistus creticus*, Dervenohoria (Attiki), Soufli (Evros) (Keltemlidis 1990); Attiki in *Pinus* sp. (Pantidou 1990); in *Pinus halepensis*, *P. brutia* and *P. nigra*, *Abies cephalonica* and *A. borisii-regis*, *Fagus sylvatica* and *Quercus conferta* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, in mixed forests of *Pinus nigra* and *Abies cephalonica*, and Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia

(Fthiotida) in *Fagus sylvatica*, Mt. Dirfi (Evoia) in *Abies* sp. and Gardiki (Fthiotida) in *Quercus* sp. (this work)
Lactarius deterrimus Gröger
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)
Lactarius insulsus Fr.
Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980)
Lactarius mitissimus (Fr.) Fr.
PF of Fracto (Drama) in *Pinus sylvestris* (Diamandis & Perlerou 1990)
Lactarius piperatus (Scop.: Fr.) S.F. Gray
(Keltemlidis 1990); NPR of Mt. Olympos in *Fagus* sp. and *Quercus conferta* (Diamandis & Perlerou 1990); in *Quercus conferta* *Q. pubescens*, and *Castanea sativa* (Diamandis 1992); in *Fagus* sp. (Diamandis & Perlerou 1994)
Lactarius pubescens (Fr.: Krombh.) Fr.
in *Quercus conferta* (Diamandis & Perlerou 1990)
Lactarius pyrogalus Fr.
in *Fagus sylvatica* (Maire & Politis 1940)
Lactarius quietus (Fr.) Fr.
in *Quercus conferta* (Diamandis 1992)
Lactarius rufus (Scop.: Fr.) Fr.
In *Picea abies* (Diamandis 1992)
Lactarius sanguifluus (Paulet.: Fr.) Fr.
in *Pinus halepensis* and *P. nigra* (Maire & Politis 1940); Kerasia (Evoia) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Lactarius scrobiculatus (Scop.: Fr.) Fr.
in *Abies* sp. (Maire & Politis 1940); in *Pinus halepensis* (Pantidou 1973); Mt. Parnitha (Attiki), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)
Lactarius serifluus (DC.: Fr.) Fr.
in *Castanea* sp. and *Pinus halepensis* (Maire & Politis 1940)
Lactarius subdulcis (Pers.: Fr.) S.F. Gray
in *Fagus* sp. (Diapoulis 1939)
Lactarius tabidus Fr.
in *Castanea* sp. (Maire & Politis 1940)
Lactarius torminosus (Schaeff.: Fr.) S.F. Gray
(Pantidou 1990)
Lactarius vellereus (Fr.) Fr.
in *Fagus* sp. (Diapoulis 1939); in *Castanea* sp. (Maire & Politis 1940); in *Castanea sativa* and *Fagus* sp. (Diamandis 1992)
Lactarius volemus Fr.
in *Quercus conferta* (Diamandis 1992); Mt. Dirfi (Evoia) in *Abies* sp. (this work)
Lactarius zonarius (Bull.: St. Amans) Fr.
in *Quercus conferta* (Diamandis & Perlerou 1990); Mt. Pilion (Magnesia) in *Fagus sylvatica*

Russula albonigra (Krombh.) Fr.
in *Castanea* sp. (Maire & Politis 1940)

Russula alutacea (Pers.: Fr.) Fr.
in *Fagus* sp. (Maire & Politis 1940)
Russula aurata (With.) Fr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1980)
Russula brunneoviolacea Crawshay
in *Castanea sativa* (Diamandis 1992); NPR of Mt. Olympos in *Quercus conferta* and *Fagus* sp. (Diamandis & Perlerou 1994)
Russula chloroides Krbh.
Andros in *Quercus* sp. (Lizon, pers. comm.)
Russula cyanoxantha (Schaeff.) Fr.
in *Fagus* sp. and *Quercus* sp. (Diapoulis 1939); in *Fagus* sp. (Maire & Politis 1940); Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); in *Fagus orientalis* and *Quercus conferta* (Diamandis 1992)
Russula delica Fr.
in *Quercus* sp. (Diapoulis 1939); in *Abies* sp., *Fagus* sp. and *Pinus nigra* (Maire & Politis 1940); Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); NPR of Mt. Olympos in *Abies borisii-regis* (Avtzis & Diamandis 1988); Attiki in *Pinus* sp. (Pantidou 1990); in *Populus* sp. plantations (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997); Mt. Oxia (Fthiotida) in *Fagus sylvatica*, and Gardiki (Fthiotida) in *Abies* sp. (this work)
Russula foetens (Pers.: Fr.) Fr.
in *Quercus pubescens* (Maire & Politis 1940); in *Quercus conferta* (Diamandis 1985); in *Quercus pubescens* and in mixed forests of *Q. conferta* and *Fagus sylvatica* (Diamandis 1992)
Russula fragilis (Pers.: Fr.) Fr.
Kerasia (Evoia) in *Pinus nigra*, and in mixed forests of *Pinus nigra* and *Quercus* sp. (Athanasiou & Theohari-Athanasiou 1997)
Russula grisea (Pers.: Secr.) Fr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Russula heterophylla (Fr.) Fr.
in *Quercus conferta* (Diamandis 1992)
Russula integra L.: Fr. ss. R. Mre
Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); in *Abies borisii-regis* (Diamandis 1985)
Russula lactea Fr.
in *Fagus* sp. (Diapoulis 1939)
Russula lepida Fr.
in *Castanea* sp., *Fagus* sp. and *Quercus pubescens* (Maire & Politis 1940); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997)
Russula maculata Quél.
in *Quercus conferta* (Diamandis 1992)
Russula mairei Sing.
in *Fagus moesiaca* and *Quercus conferta* (Diamandis & Perlerou 1990); in *Fagus orientalis* and *Quercus conferta* (Diamandis & Perlerou 1994); Gardiki (Fthiotida) in *Abies* sp. (this work)

Russula nigricans (Bull.) Fr.
in *Pinus* sp. (Maire & Politis 1940)
Russula nitida (Pers. Fr.) Fr.
Mt. Parnitha (Attiki) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980)
Russula ochroleuca (Pers.: Sécr.) Fr.
in *Fagus orientalis* and *Quercus conferta* (Diamandis 1992)
Russula olivacea (Schaeff.: Secr.) Fr.
in *Fagus sylvatica* (Diamandis 1985); in *Fagus orientalis* and *Quercus conferta* (Diamandis 1992)
Russula pectinata (Bull.) Fr.
in *Pinus halepensis* and *Quercus pubescens* (Maire & Politis 1940)
Russula queletii Fr.
in *Abies* sp. and *Pinus nigra* (Maire & Politis 1940); Hania (Magnesia) in *Fagus sylvatica* (Pantidou & Gonou 1984)
Russula sanguinea (Bull.: St. Amans) Fr.
in *Pinus nigra* (Maire & Politis 1940); in *Pinus brutia* and *P. nigra* (Diamandis 1992)
Russula sardonia Fr.
NPR of Mt. Olympos in *Pinus brutia* and *Pinus nigra* (Diamandis & Perlerou 1990]; in *Pinus brutia*, *P. halepensis* and *P. nigra* (Diamandis & Perlerou 1994); Kerasia (Evoia) in *Pinus nigra*, and in Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Russula torulosa Bres.
Kerasia (Evoia) in *Pinus nigra*, and Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Russula turci Bres.
in *Pinus* sp. and *Picea abies* (Diamandis 1992)
Russula violacea Quél.
(Maire & Politis 1940)
Russula virescens (Schaeff.: Zant.) Fr.
in *Fagus sylvatica* and *Quercus conferta* (Diamandis 1992)
Russula xerampelina (Schaeff.) Fr.
in *Fagus* sp. (Maire & Politis 1940)

Schizophyllales
Schizophyllaceae:
Henningsomyces candidus (Pers.: Schleich.) Kuntze
Elati (Karditsa) on *Abies* sp. (Minter 1988); on *Fagus orientalis* (Diamandis 1992)

Schizophyllum commune Fr.
on *Opuntia* sp. (Bary de St. Vincent 1838); on *Abies* sp. and *Populus alba* (Maire & Politis 1940); on *Vitis vinifera* (Petrak 1943); Veroia (Pella) on *Juglans regia*, Thessaloniki on *Malus sylvestris*, Thessaloniki on *Prunus avium*, Thessaloniki on *Pyrus communis*, Veroia (Pella) and Florina on *Quercus coccifera*, and Thessaloniki on *Vitis vinifera* (Sarejanni & Demetriades 1951); on *Populus* sp. (Kailidis 1962); Hania (Magnesia) on *Fagus sylvatica* (Pantidou & Gonou 1984), on *Fagus* and *Populus* spp. (Diamandis 1983); Kalambaka (Trikala) on *Platanus orientalis*, Mt. Ossa (Larissa) on *Fagus sylvatica*, Kastanea on *Quercus* sp., Mt. Olympos on *Castanea sativa* (Minter

1988); (Pantidou 1990); on *Abies borisii-regis* (Diamandis & Perlerou 1990); on *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); on *Abies cephalonica* (Diamandis & Perlerou 1994); Olympia (Eleia) on *Populus alba* (Kotlaba & Klan 1994); Mt. Oxia (Fthiotida) on *Fagus sylvatica*, Oiti (Fthiotida) on *Abies* sp. and Mt. Pilion (Magnesia) on *Fagus sylvatica* (this work)

Stromatoscyphaceae:
Porotheleum fimbriatum (Pers.) Fr.
Katerini (Pieria) on *Quercus* sp. (Kotlaba & Klan 1994)

Sclerodermatales
Astraeaceae:
Astraeus hygrometricus (Pers.) Morg. {= *Geastrum hygrometricum* Fr.}
Petralona Cave (Halkidiki), Vassilika (Thessaloniki), Meteora (Trikala), Iberon Monastery, Pantokratoros Monastery and Philotheou Monastery (Agion Oros) (Minter 1988); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992)

Sclerodermataceae:
Scleroderma areolatum Ehrenb.
in *Quercus conferta* (Diamandis 1983); in mixed forests of *Fagus* sp. and *Quercus conferta* (Diamandis 1992)
Scleroderma bovista Fr.
(Heufler 1868); (Maire & Politis 1940); in *Pinus brutia* (Diamandis 1992)
Scleroderma citrinum Pers.
in *Quercus conferta* (Diamandis 1992)
Scleroderma polyrhizum (J.F. Gmel.) Pers. {= *Scleroderma geaster* Fr.}
(Maire & Politis 1940); Mt. Olympos in *Pinus* sp., and *Quercus* sp. (Minter 1988); in *Castanea sativa* (Diamandis & Perlerou 1990)
Scleroderma verrucosum (Bull.) Pers.
(Maire & Politis 1940); in *Abies borisii-regis* (Diamandis 1985)

Sphaerobolaceae:
Sphaerobolus stellatus Tode: Pers.
(Diamandis 1985); on *Castanea sativa* (Diamandis & Perlerou 1990); on *Fagus* sp. (Diamandis 1992)

Stereales
Corticiaceae:
Aleurodiscus amorphus (Fr.) Schroet.
Elati (Karditsa) on *Abies* sp. (Minter 1988)

Amylostereum laevigatum (Fr.) Boid.
Elati (Karditsa) on *Juniperus* sp. (Minter 1988)

Auriculariopsis ampla (Lév.) Maire
on *Populus* spp. (Diamandis & Perlerou 1990)

Corticium roseum Pers. {= *Laeticorticium roseum* (Fr.) Donk}
Mt. Olympos on *Quercus cerris*, Mt. Ossa (Larissa) on *Phillyrea* sp., Meteora (Trikala) on *Phillyrea media* (Minter 1988)

Dacryobolus karstenii (Bres.) Oberw.: Parm.
Kastanea on *Pinus* sp. (Minter 1988)
Dacryobolus sudans Fr.: Fr.
Meteora (Trikala) on *Quercus frainetto* (Minter 1988)

Grandinia crustosa (Pers.: Fr.) Fr. {= *Hyphodontia crustosa* (Fr.) Erikss.}
Mt. Olympos on *Abies* sp. (Minter 1988)

Hyphoderma incarnata
Meteora (Trikala) on *Phillyrea* sp. (Minter 1988)
Hyphoderma pallidum
Kastanea on *Pinus* sp. (Minter 1988)
Hyphoderma praetermissum
Mt. Olympos on *Abies* sp. [Minter]

Hyphodontia alutacea (Fr.) Erikss. {= *Corticium alutaceum* Bres.: Schrad.}
(Heufler 1868)
Hyphodontia quercina (Pers.: Fr.) Erikss.
Mt. Ossa (Larissa) on *Tilia* sp. (Minter 1988); Tsepelovon (Ioannina) on *Quercus* sp. (Kotlaba & Klan 1994)
Hyphodontia sambuci (Pers.) Erikss.
on *Fagus sylvatica* (Diamandis 1985)

Megalocystidium luridum (Bres.) Boidin
Kastanea on *Quercus* sp. and on *Juniperus* sp., Meteora (Trikala) (Minter 1988)

Meruliopsis corium (Fr.) Ginns {= *Merulius papyrinus* (Bull.: Fr.) Quél.}
= *Byssomerulius corium* (Fr.) Parm.}
on *Nerium oleander* (Petrak 1943); Mt. Olympos on *Castanea* sp. and on *Quercus cerris*, Mt. Ossa (Larissa) on *Fagus sylvatica* (Minter 1988)

Merulius tremellosus Fr.
(Diamandis 1985); on *Fagus sylvatica* (Diamandis & Perlerou 1990)

Phanerochaete laevis (Pers.: Fr.) Erikss. & Ryv.
on *Quercus coccifera* (Diamandis & Perlerou 1990)
Phanerochaete sordida (Karst.) Erikss. & Ryv.
Mt. Ossa (Larissa), Mt. Olympos on *Castanea sativa* (Minter 1988)
Phanerochaete velutina (Fr.) Karst.
on *Pinus radiata* (Diamandis 1992)

Phlebia centrifuga Fr.
Kastanea on *Quercus* sp. (Minter 1988)

Phlebia queletii Fr.
Mt. Olympos on *Abies* sp., Kastanea on *Abies* sp., Elati (Karditsa) on *Abies* sp. (Minter 1988)
Phlebia radiata Fr. {= *Phlebia merismioides* Fr.}
on *Fagus sylvatica* (Diamandis 1985); PF of Fracto (Drama) on *Picea abies* (Avtzis & Diamandis 1988); on *Fagus* spp. (Diamandis 1992)
Phlebia rufa (Fr.) Christ. {= *Merulius rufus* Pers.: Fr.}
on *Castanea* sp. (Maire & Politis 1940); on *Fagus orientalis* (Diamandis 1992)

Phlebiopsis gigantea (Fr.) Jül.
Mt. Olympos on conifers (Minter 1988)
Phlebiopsis roumeguerii Fr.
Philotheou Monastery (Agion Oros) on *Castanea sativa*, Kastanea on *Quercus* sp., Gefyra Murgana on *Platanus* sp., Meteora (Trikala) on *Quercus frainetto* (Minter 1988)

Pulcherricium caeruleum (Pers.) Parm. {= *Corticium caeruleum* }
on *Pyrus communis* (Diamandis 1985); Mt. Ossa (Larissa), Meteora (Trikala) on *Quercus pubescens*, Mt. Olympos on *Quercus ilex* (Minter 1988); on *Pirus amygdaliformis* and *Quercus conferta* (Diamandis 1992); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)

Radulomyces confluens (Fr.) Christ. {= *Cerocorticium confluens* (Fr.: Fr.) Jül. & Stalpers, = *Merulius confluens* Schw.: Fr.}
on *Platanus* sp. (Maire & Politis 1940, Petrak 1943); Mt. Olympos on *Abies* sp., Elati (Karditsa) on *Abies* sp. (Minter 1988); Romvi (Argolis) on *Anagyris foetida* (Kotlaba & Klan 1994)
Radulomyces molare (Chaill.: Fr.) Christ. {= *Cerocorticium molare* (Chaill.: Fr.) Jül.}
Meteora (Trikala) on *Quercus frainetto* (Minter 1988); on *Quercus conferta* (Diamandis & Perlerou 1990)

Schizopora paradoxa (Schrad.: Fr.) Donk.
on *Fagus sylvatica* (Diamandis 1985); NPR of Mt. Olympos and PF of Fracto (Drama) on *Pinus nigra* (Avtzis & Diamandis 1988); on *Fagus orientalis* (Diamandis 1992)

Subulicystidium longisporum (Pat.) Parm.
Mt. Ossa (Larissa) on *Tilia* sp. (Minter 1988)

Trechispora farinacea (Pers.: Fr.) Liberta
Stavronikita Monastery (Agion Oros) on *Quercus ilex*, Mt. Olympos on *Castanea sativa* (Minter 1988)
Trechispora vaga (Fr.) Liberta
Philotheou Monastery (Agion Oros) on *Castanea sativa* (Minter 1988)

Tubulicrinis accedens (Bourd. & Galz.) Donk
Mt. Ossa (Larissa) on *Fagus sylvatica* (Minter 1988)
Tubulicrinis medius (Boud. & Galz.) Oberw.

Mt. Olympos on *Pinus leucodermis* (Minter 1988)

Vesiculomyces citrinus (Pers.) Hagström
Kastanea on *Juniperus* sp. (Minter 1988)

Vuilleminia comedens (Nees) Maire
Kastanea on *Quercus pubescens*, Mt. Olympos on *Quercus pubescens* (Minter 1988); on *Quercus conferta* and *Fagus* sp. (Diamandis 1992)
Vuilleminia coryli (Boid.) Lanq. & Gilles
Tsepelovon (Ioannina) on *Carpinus orientalis* (Kotlaba & Klan 1994)
Vuilleminia megalospora
Mt. Olympos on *Quercus ilex*, Meteora (Trikala) on *Quercus coccifera* (Minter 1988)

Peniophoraceae:
Peniophora incarnata (Pers.: Fr.) Karst.
Mt. Ossa (Larissa) on *Fagus sylvatica*, Mt. Olympos on *Quercus cerris*, Meteora (Trikala) on *Quercus frainetto* (Minter 1988); on *Castanea sativa* (Diamandis 1992)
Peniophora lycii (Pers.) Hühn. & Litsch.
(Diamandis 1985); Mt. Ossa (Larissa) (Minter 1988)
Peniophora meridionalis
Mt. Olympos on *Castanea* sp. (Minter 1988)
Peniophora piceae (Pers.) Eriks.
Elati (Karditsa) on *Abies* sp., Kastanea on *Abies* sp., Mt. Olympos on *Abies borisii-regis* (Minter 1988); on *Abies* sp. (Diamandis 1992)
Peniophora pini (Fr.) Boid.
Mt. Olympos on *Pinus leucodermis* (Minter 1988)
Peniophora quercina (Fr.) Cke
on *Quercus conferta* (Diamandis 1983); Mt. Olympos on *Quercus ilex*, Kastanea on *Quercus* sp., Meteora (Trikala) on *Quercus* sp., Mt. Ossa (Larissa) on *Tilia* sp. and *Quercus* sp. (Minter 1988); on *Quercus pubescens*, *Quercus conferta* and *Fagus orientalis* (Diamandis & Perlerou 1990); on *Castanea sativa* (Diamandis 1992)
Peniophora violaceo-livida (Sommerf.) Massee
on *Quercus coccifera* (Diamandis & Perlerou 1990)

Steccherinaceae:
Steccherinum fimbriatum (Pers.: Fr.) Erikss.
Mt. Ossa (Larissa) on *Quercus* sp. (Minter 1988)
Steccherinum ochraceum (Pers.: Fr.) S.F. Gray
(Avtzis & Diamandis 1988); on *Fagus orientalis* (Diamandis 1992); PF of Fracto (Drama) on *Picea abies* (Diamandis & Perlerou 1994)

Stereaceae:
Chondrostereum purpureum (Fr.) Pouz. {= *Stereum purpureum* Fr.: Fr.}
on *Prunus persica* and *Pyrus communis* (Anonymous 1971); on *Populus alba* (Diamandis 1983)

Lopharia heterospora (Burt.) Reid

City of Rhodos (Rhodos) on *Euphorbia pulcherrima* (Plank 1980)

Stereum gausapatum (Fr.) Fr.
on *Quercus* spp. (Diamandis 1985); Taxiarchis (Halkidiki) on *Quercus* sp. (Minter 1988); on *Castanea sativa* and *Quercus conferta* (Diamandis 1992)
Stereum hirsutum (Wild.: Fr.) S.F. Gray
(Heufler 1868); on *Fagus* sp. (Diapoulis 1939); on *Vitis vinifera* (Sarejanni 1939); on *Arbutus* sp., *Carpinus* sp., *Castanea* sp., *Erica* sp., *Fagus* sp., *Ostrya* sp., *Phillyrea* sp., *Pinus* sp., and *Quercus* sp. (Maire & Politis 1940); (Petrak 1943); on *Corylus avellana* (Anonymous 1971); on *Fagus sylvatica* (Diamandis 1983); NPR of Mt. Olympos, NPR of Pindos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Kastanea on *Quercus* sp., Mt. Olympos on *Castanea* sp., Meteora (Trikala) on *Quercus pubescens*, Mt. Ossa (Larissa) on *Tilia* sp., *Fagus sylvatica*, and *Castanea sativa*, Elati (Karditsa) on *Abies borissii-regis* (Minter 1988); on *Quercus conferta*, *Q. pubescens*, *Fagus* spp. and *Betula* sp. (Diamandis 1992); Tsepelovo (Ioannina) on *Quercus frainetto*, and Nafplio (Argolis) on *Ligustrun lucidum* (Kotlaba & Klan 1994)
Stereum insignitum Quél.
on *Fagus* sp. (Maire & Politis 1940)
Stereum ochraceo-flavum (Schw.) Ellis {= *Stereum rameale* (Pers.: Fr.) Burt}
Mt. Olympos on *Quercus ilex* (Minter 1988); on *Quercus conferta* (Diamandis 1992)
Stereum rugosum (Pers.: Fr.) Fr.
on *Quercus frainetto* (Maire & Politis 1940); on *Quercus conferta* (Diamandis 1992); Mt. Oxia (Fthiotida) on *Fagus sylvatica* (this work)
Stereum sanguinolentum (A. & S.: Fr.) Fr.
on *Pinus halepensis* (Maire & Politis 1940); Kastanea in *Pinus nigra*, Elati (Karditsa) on *Abies* sp. (Minter 1988)

Thelephorales
Bankeraceae:
Phellodon melaleucus (Fr.) Karst.
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981)
Phellodon niger (Fr.: Fr.) Karst.
Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); NPR of Mt. Olympos on *Pinus nigra* (Avtzis & Diamandis 1988)

Thelephoraceae:
Boletopsis grisea (Pk.) Bond. & Sing. {= *Polyporus griseus* Peck}
Mt. Parnitha (Attiki) on *Abies cephalonica* (Pantidou 1980)
Boletopsis leucomelaena (Pers.) Fayod {= *Polyporus leucomelas* Pers.: Fr.}
on *Abies cephalonica* (Pantidou 1973)
Boletopsis subsquamosa (Fr.) Kotl. & Pouzar
Tatoi (Attiki) (Pantidou 1990)

Hydnellum aurantiacum (Fr.) Karst.
Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983)
Hydnellum caeruleum (Horn.: Pers.) Karst.
Chrisovitsi (Arkadia) in *Abies cephalonica* (Pantidou 1980)

Hydnellum ferrugineum (Fr.: Fr.) Karst.
in *Abies cephalonica* (Diamandis 1992)
Hydnellum peckii Banker: Peck
Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983)
Hydnellum scrobiculatum (Fr.: Sécr.) Karst.
in *Alnus glutinosa* (Diamandis 1992)
Hydnellum suaveolens (Scop.: Fr.) Karst.
Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983)

Sarcodon fuligineo-violaceus (Kalchbr.: Fr.) Pat.
Mt. Parnitha (Attiki), Chrisovitsi (Arkadia), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980)
Sarcodon imbricatum (Linn.: Fr.) Karst.
Mt. Mainalon (Peloponnese) in *Abies cephalonica* (Diamandis & Minter 1983); in *Picea abies* (Diamandis 1992); Kerasia (Evoia) in *Pinus nigra*, and in Mt. Kissavos (Larissa) in *Pinus nigra* (Athanasiou & Theohari-Athanasiou 1997)
Sarcodon laevigatus (Sw.: Fr.) Karst.
in *Pinus nigra* (Maire & Politis 1940)
Sarcodon lepideus Maas Geest.
Andros in *Quercus ilex* (Lizon, pers. comm.)
Sarcodon scabrosus (Fr.) Karst.
Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1980); Attiki in *Abies* sp. (Pantidou 1990)
Sarcodon talpa Maas Geest.
in *Abies cephalonica* (Pantidou 1973)

Thelephora spiculosa (Fr.) Burt.
NPR of Mt. Olympos in *Fagus orientalis* (Diamandis & Perlerou 1994); in *Fagus orientalis* (Diamandis 1992)
Thelephora terrestris (Ehr.) Fr.
in *Pinus brutia* (Diamandis 1985)

Heterobasidiomycetes

Auriculariales

Auriculariaceae:

Auricularia auricula-judae (Bull.) Wettst. {= *Auricularia auricula* (Hook.) Underwood}
on *Citrus* sp. (Heufler 1868); on *Platanus* sp., *Quercus macrolepis* and *Sambucus nigra* (Maire & Politis 1940); (Petrak 1943); Mt. Ossa (Larissa) (Minter 1988); Setta (Evoia) on *Platanus orientalis* (Keltemlidis 1990); Attiki on *Platanus orientalis* (Pantidou 1990); on *Abies borisii-regis* (Diamandis 1992); Andros on *Juglans regia* (Lizon, pers. comm.); Gardiki (Fthiotida) and Mt. Parnitha (Attiki) on *Abies* sp., and Mt. Pilion (Magnesia) on *Platanus orientalis* (this work)
Auricularia mesenterica (Dicks.) Pers.
(Maire & Politis 1940); on *Quercus conferta* (Diamandis 1985); Mt. Olympos on *Ulmus* sp., Gefyra Murgana (Trikala) on *Platanus* sp., Dion (Pella) on *Populus* sp. (Minter 1988); on *Ulmus pediata* (Diamandis 1992)

Dacrymycetales

Dacrymycetaceae:

Calocera cornea (Batsch: Fr.) Fr.
on *Fagus* sp. and *Quercus coccifera* (Maire & Politis 1940); NPR of Mt. Olympos and PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); on *Quercus conferta* and *Fagus* spp. (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica*, and Gardiki (Fthiotida) in *Abies* sp. (this work)

Calocera viscosa (Pers.: Fr.) Fr.
Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1981); PF of Fracto (Drama) on *Picea abies* (Avtzis & Diamandis 1988); Kastanea on *Abies* sp., Elati (Karditsa) on *Abies* sp. (Minter 1988); on *Abies borisii-regis* (Diamandis 1992); Mt. Oxia (Fthiotida) in *Fagus sylvatica*, and Gardiki (Fthiotida) in *Abies* sp. (this work)

Dacrymyces capitata Schw.
Kastanea, Mt. Olympos on *Abies* sp.; Elati (Karditsa) on *Abies borissii-regis* (Minter 1988)

Dacrymyces stillatus Nees: Fr.
Mt. Mainalon (Arkadia) on *Abies cephalonica* (Diamandis & Minter 1981); on *Abies cephalonica*, *A. borisii-regis*, *Picea abies*, *Pinus nigra*, *P. sylvestris*, *Fagus* sp. and *Quercus* sp. (Diamandis 1992)

Dacrymyces variisporus McNabb
on *Pinus nigra* (Diamandis 1992)

Tremellales

Exidiaceae:

Exidia glandulosa Fr.
on *Fagus sylvatica* (Diamandis 1985); NPR of Mt. Olympos and NPR of Pindos on *Fagus sylvatica* (Avtzis & Diamandis 1988); Meteora (Trikala) on *Quercus pubescens*, Mt. Ossa (Larissa) on *Tilia* sp. (Minter 1988); on *Quercus conferta* (Diamandis 1992)

Exidia pithya A. & S.: Fr.
NPR of Samaria (Crete) on *Pinus brutia* (Diamandis & Perlerou 1990)

Exidia saccharina Alb. & Schw.: Fr.
Mt. Mainalon (Peloponnese) on *Abies cephalonica* (Diamandis & Minter 1983); on *Pinus brutia* (Diamandis 1992)

Pseudohydnum gelatinosum (Scop.: Fr.) Karst.
on *Abies* sp. and *Pinus* sp. (Maire & Politis 1940); Mt. Parnitha (Attiki), Vitina (Arkadia) in *Abies cephalonica* (Pantidou 1973, Pantidou 1980); Mt. Mainalon (Arkadia) in *Abies cephalonica* (Diamandis & Minter 1981); PF of Fracto (Drama) on *Fagus sylvatica* (Avtzis & Diamandis 1988); Elati (Karditsa) in *Abies* sp. (Minter 1988); on *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Kerasia (Evoia) in mixed forests of *Pinus nigra* and *Abies cephalonica* (Athanasiou & Theohari-Athanasiou 1997); Mt. Dirfi (Evoia) on *Abies* sp. (this work)

Tremiscus helvelloides (DC.: Pers.) Donk {= *Phlogiotis helvelloides* (Fr.) Martin}

Mt. Parnitha (Attiki), Chrisovitsi (Arkadia), Ainos (Kefallonia) in *Abies cephalonica* (Pantidou 1980); Mt. Mainalon (Arkadia) on *Abies cephalonica* (Diamandis & Minter 1981); on *Abies borisii-regis* (Diamandis 1985); in *Abies cephalonica* and *A. borisii-regis* (Diamandis 1992); Mt. Oiti (Fthiotida) in *Abies* sp. (this work)

Tremellaceae:

Tremella foliacea Pers.: Fr.

Iberon Monastery (Agion Oros) on *Castanea sativa* (Minter 1988); on *Quercus ilex* and *Quercus pubescens* (Diamandis 1992)

Tremella encephala Pers.

Attiki on conifers (Pantidou 1990)

Tremella lutescens Pers.: Fr.

on *Quercus conferta* (Diamandis & Perlerou 1990); (Diamandis 1992)

Tremella mesenterica Fr.

on *Pinus nigra*, *P. halepensis*, *Quercus coccifera* and *Q. pubescens* (Maire & Politis 1940); Attiki (Pantidou 1990); on *Quercus conferta* and *Q. pubescens* (Diamandis 1992); Gardiki (Fthiotida) on *Carpinus* sp. (this work)

Tulostomatales

Tulostomataceae:

Tulostoma brumale Pers.: Pers.

Vassilika (Thessaloniki) (Minter 1988); in sandy fields (Diamandis 1992)

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PHYLOGENETIC RELATIONSHIPS IN THE SACCHAROMYCES CEREVISIAE COMPLEX OF SPECIES.

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ABSTRACT

Phylogenetic relationships within *Saccharomyces cerevisiae* complex between the neotype strain of *Saccharomyces cerevisiae sensu stricto* and type and neotype strains of a number of synonyms were estimated by comparison of nucleotide sequences of domain D2 of 25S rRNA and internal transcribed spacers regions ITS1-5.8SrDNA-ITS2. The sequences have been analyzed for phylogenetic implications using parsimony and distant methods. The species examined were *S. cerevisiae, S. bayanus, S. carlsbergensis, S. chevalieri, S. ellipsoideus, S. paradoxus, S. pastorianus* and *S. uvarum.* It was shown that phylogenetic relationships inferred from analyses of ITS sequences correlate with results from DNA-DNA hybridization, with exception that *S. uvarum* remains distant from *S. bayanus* and the other species.

INTRODUCTION

Since the first description of the type species *Saccharomyces cerevisiae* by Meyen in 1838, validated by Rees in 1870 and emended by Hansen in 1883, the yeast genus *Saccharomyces* has known an extensive development, with up to 163 species and varieties described untill 1984. Guilliermond (1912) already distributed 44 name species of the genus into 6 group; one of which, headed by *S. cerevisiae,* included 21 species related by their broad fermentative capacities and their occurrence in beer and wine making. Lodder and Kreger-van Rij (1952) recognized only 33 of existing species and varieties, adding 4 new species in the genus. They typified *S. cerevisiae* var. *cerevisiae* designating as neotype the isolate CBS 1171 from the top fermenting yeast from a brewery in Rotterdam and synonymising 15 basionyms under that variety and 14 basionyms under the variety *S. cerevisiae* var. *ellipsoideus.* They kept *S. bayanus, S. carlsbergensis, S. chevalieri, S. pastorianus* and *S. uvarum.* van der Walt (1956) restricted the concept *Saccharomyces* and transferred 4 species to *Kluyveromyces.* van der Walt *in* Lodder (1970) monographed the genus with 41 species and 3 varieties, including 21 species added since 1952. Aware of the heterogeneity of the genus, he divided the genus into 4 groups, designating *Saccharomyces sensu stricto* the group I of *S. cerevisiae* and 20 fermentation-associated species, while group II and III were designated to belong to *Zygosaccharomyces* and *Torulaspora* or *Debaryomyces,* respectively, and group IV to a heterogeneous assemblage of 10 species completing *Saccharomyces sensu lato.* 38 synonymous basionyms, including the variety *ellipsoideus* were assigned to *Saccharomyces cerevisiae. S. bayanus (S. pastorianus), S. chevalieri (S. paradoxus)* and *S. uvarum (S. carlsbergensis)* were kept separate. Campbell (1972) performed numerical analysis of the serological reactions of the *Saccharomyces* species, and reduced the group of *S. cerevisiae* to 12 species. Yarrow and Nakase (1975) differentiated the four van der Walt's groups by their DNA base composition and characterized group I (*Saccharomyces sensu stricto*) with 38.8-40.7% GC and 2 species only, *S. cerevisiae* (with *S. bayanus, S. chevalieri, S. diastaticus, S. italicus, S. uvarum* and 12 others as synonyms) and *S. kluyveri,* while group IV was 32-38.9% GC. Yarrow *in* Kreger-van Rij (1984) restricted the genus *Saccharomyces* to 7 species, *S. cerevisiae* (with 69 synonymous valid basionyms) representing alone van der Walt's group I ("*Saccharomyces sensu stricto*", here further called *Saccharomyces cerevisiae* complex) and 6 species of group IV.

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Rosini *et al.* (1982) had demonstrated that *Saccharomyces cerevisiae* is a complex species by DNA-DNA hybridization technique. Comparing type strains of so-called synonymous species, they found two groups that differed by 70% DNA-DNA dissimilarity. One group of *S. cerevisiae, S. chevalieri* and *S. italicus* and another group of *S. bayanus* and *S. uvarum,* with over 90% and 95.2% relatedness within respective groups. Vaughan-Martini and Kurtzman (1985) confirmed by DNA hybridization of type strains of 24 synonymous species of *S. cerevisiae sensu* Yarrow (1984) the existence of 4 distinct species, *S. cerevisiae* (with 15 synonyms, over 90% homology), *S. bayanus* (with 5 synonyms), *S. kluyveri*, and *S. carlsbergensis* in an intermediate position between *S. bayanus* (72% homology) and *S. cerevisiae* (57% homology) (Fig.1).

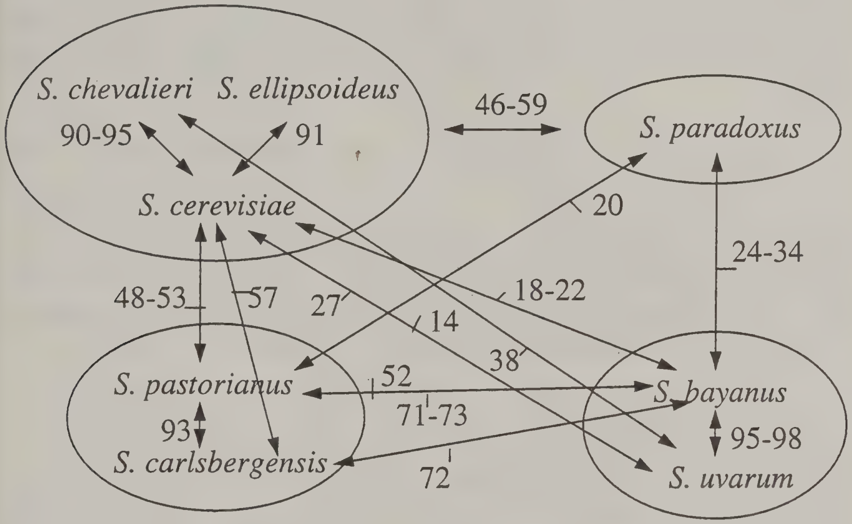
S. chevalieri
S. ellipsoideus
90-95
91
S. cerevisiae
46-59
S. paradoxus
20
24-34
48-53
57
27
18-22
14
38
52
S. pastorianus
93
S. carlsbergensis
71-73
72
S. bayanus
95-98
S. uvarum

Fig.1. % of DNA-DNA relatedness between *S. cerevisiae* complex of species. Data from: Vaughan-Martini & Martini, 1994 ECB Proceeding p.36; Rosini *et al.* 1982 Eur. J. Appl. Microbiol. Biotechnol. 15:188-193; Vaughan-Martini & Kurtzman 1985, Int. J. Syst. Bact. 35-508-511; Vaughan-Martini 1989, Syst. Appl. Microbiol. 12:119-122; Vaughan-Martini & Martini 1987, Antonie van Leewenhoek 53:77-84; Vaughan-Martini & Martini 1995, J. Indust. Microbiol. 14:514-522;

Vaughan-Martini and Martini (1987) confirmed the distinction of *S. cerevisiae* (with 8 more synonyms), *S. bayanus* (with 3 more synonyms) and *S. pastorianus* (with 2 synonyms including *S. carlsbergensis*). The DNA-DNA relatedness was 18-22% between *S. cerevisiae* and *S. bayanus*, 48-53% between *S. cerevisiae* and *S. pastorianus* and 71-73% between *S. bayanus* and *S. pastorianus*. Vaughan-Martini and Martini (1989, 1994, 1995) pointed out that confusion of the four species led to numerous misapplications of the names in research and industry. Indeed the reason of the discordant observations of Bicknell and Douglas (1970) who found 96% relatedness of *S. carlsbergensis* to *S. cerevisiae* (against 57% here) and 40% of *S. uvarum* to *S. cerevisiae* (against 14% here), was that they did not use the type strains of the species. Vaughan-martini and Martini (1995) also indicated that *S. paradoxus* is the only one of the four recognized species to currently occur in nature and *S. cerevisiae* is extremely rare on grapes and other fruits. A synoptic account of the history of the genus *Saccharomyces*, and particularly of the *S. cerevisiae* complex ("*Saccharomyces sensu stricto*") has given by Barnett (1992) and Vaughan-Martini and Martini (1989, 1994, 1993, 1995).

Kurtzman and Robnett (1991) approached phylogenetic relationships among species of *Saccharomyces* and some other yeast genera, using partial sequencing of 25S and 18S rRNAs. Two regions of 300 nucleotides starting from bases 635 and 1841 of 25S rRNA and one of 300 nucleotides starting from base 1627 of 18S rRNA were sequenced from type strains. They showed that *S. cerevisiae, S. paradoxus, S. unisporus, S. servazii, S. castellii, S. dairensis, S. exiguus, S. kluyveri* can be distinguished from one another by nucleotide differences with exception of *S. pastorianus* and *S. bayanus.* The later species are clustered together, close to *S. cerevisiae.* That could corroborate the assertion of Vaughan-Martini and Kurtzman (1985) that *S. pastorianus* might be a partial amphidiploid derived from an infrequent mating between *S. cerevisiae* and *S. bayanus*

In the present work, sequences of divergent domain (D2) of the 25S rRNA and of ITS1-5.8SrDNA-ITS2 region were determined on the neotype strain of *Saccharomyces cerevisiae* and the type or neotype strains of *S. bayanus, S. carlsbergensis, S. chevalieri, S. ellipsoideus, S. paradoxus, S. pastorianus* and *S. uvarum* classically considered synonymous of *S. cerevisiae.* Internal transcribed spacers region was chosen because numerous experiments demonstrated their usefulness for systematics in *Phytophthora* (Lee and Taylor 1992), in the *Sclerotiniaceae* (Carbone and Kohn, 1993), in *Gastrosuillus* and *Suillus* (Baura *et al.* 1992), in rusts (Zambino and Szabo 1993) in *Talaromyces, Penicillium* (LoBuglio *et al.* 1993), *Ganoderma* (Moncalvo *et al.* 1995), black yeasts (Uithoff *et al.* 1996) and *Lypomyces* (Gouliamova *et al.* 1997).

MATERIALS AND METHODS

Strains examined

The strains investigated were:

MUCL 31497=CBS 1171 NT of *S. cerevisiae sensu stricto.*
MUCL 31496=CBS 1538 NT of *S. pastorianus.*
MUCL 31495=CBS 380 T of *S. bayanus.*
MUCL 31498=CBS 432 NT of *S. paradoxus.*
MUCL 27815=CBS 400 T of *S. chevalieri.*
MUCL 27835=CBS 395 T of *S. uvarum.*
MUCL 38889=CBS 1513 T of *S. carlsbergensis.*
MUCL 38888=CBS 1395 NT of *S. ellipsoideus.*

Cells culturing

Cells were grown at 25°C in 100 ml of DYP medium (containing: 2% dextrose, 0.5% yeast extract, 1% peptone) on rotary shaker at 200 rpm during 16 h. Cells were washed with sterile water, harvested by centrifugation, lyophilized and stored at +4° C.

rRNA extraction and sequencing

Total cellular rRNA was isolated according to procedures described by Guadet *et al.* (1989) and Chirgwin *et al.* (1979). Integrity of purified rRNA was assessed by non-denaturating agarose gel electrophoresis. Purity of rRNA was estimated from spectrophotometric absorbance ratios 260/280=1.7-2.0.

25S rRNA was sequenced by Sanger (1977) dideoxynucleotide chain termination method using reverse transcriptase RNA sequencing kit (United States Biochemicals, Clevland, Ohio) with slight modifications. Avian myeloblastosis virus (AMV) reverse transcriptase (20 000 units/ml) was purchased from Promega corporation. (a-^{35}S) ATP (1000 Ci/mmol, 10 mCi/µl) was obtained from Amersham, UK. Sequences of the primers used are: 5'TCCCTTTCAACAATTTCACG3' (Gueho, personal communication), 5'GGTCCGTGTTCAAGACGG3' (Kurtzman and Robnett 1991).

For a set of four reactions, 10 pmoles of primer solution in water is mixed with rRNA (50-500 pmoles) and water to a total volume of 10 µl. Reverse transcription is performed at 45° C for 10 min. Nucleotide fragments generated in the chain termination reactions were separated on 8% acrylamide-8M urea gels and visualized by autoradiography.

DNA extraction and Polymerase chain reaction (PCR)

DNA extraction from yeasts cells was performed using the SDS protocol of Raeder and Broda (1985). Each PCR reaction had a total volume of 50 µl and contained genomic DNA (100 ng), 1.75 mM $MgCl_2$, 200 µM each dNTPs, 2.5 units of Tag DNA polymerase (Boehringer, Mannheim) and 50 µM each of the (biotinilated) ITS1-5'TCCGTAGGTGAACCTGCGG3' (White *et al.* 1990) and PN16-5' TCCCTTTCAACAATTTCACG3' (Sherriff *et al.* 1994). The reaction mixture was covered with a drop of mineral oil (Sigma) and subjected to 28 cycles of amplification. Each cycle consisted of 1 min at 94°C, 1 min at 58°C, and 2 min at 68°C, 10 min at 72°C. Amplified samples were analyzed by electrophoresis on 1.5% ultraPURE electrophoresis Grade agarose (Life Technologies Inc.) gels with ethidium bromide staining. PCR reaction products were purified using QIAquick PCR purification kit (QIAGEN, Belgium) following the manufacturer's protocol.

Solid-phase sequencing of biotinilated PCR product was done with magnetic beads coated with streptavidin (Dynal, Oslo, Norvay). The immobilization of PCR products on magnetic beads was performed as described by Hultman *et al.* (1991). Sequencing reactions were performed on DNA bound to the beads using T7 DNA Polymerase kit for DNA sequencing (Pharmacia Biotech). Primers for sequencing were: PN10-5'TCCGCTTATTCATATGCTTAAG3'
and PN12-5'GTTACACGCAAGTTTCTAAGC3' (Sherriff *et al.* 1994).

Phylogenetic analyses

DNA sequences were aligned using Clustal W program (1.4) (Higgins and Sharp 1988) using FAST algorithm. Sequences were aligned without ambiguities.

The sequences have been analyzed for phylogenetic implications using parsimony and distant methods. Most parsimonious trees were determined from the program PAUP, version 3.1.1 (Swofford 1993) using Exhaustive search option. Gaps were treated as missing. MULPARS option was in effect. Initial MAXTREES setting was 100. Branches having maximum length zero collapsed to yield polytomies. Topological constraints were not enforced. Bootstrap heuristic search option was used to evaluate reliability of branches in obtained trees. Options used were : TBR swaping algorithm, simple sequence addition, sleepest desent option was in effect.

50% Majority-rule consensus trees were determined from distance method, using Kimura's two parameters model of nucleotide substitution (default options, DNADIST program from PHYLIP package 3.57, Felsenstein, 1993). The distance matrices generated by DNADIST were analysed using UPGMA method of the NEIGHBOUR program (default options) and a majority-rule Consensus tree was produced by CONSENSE program.

D2 and ITS1-5.8S rDNA-ITS2 sequences of *C. albicans* have been chosen as outgroup (De Rijk *et al.* 1977, Mercure *et al.* 1993).

All sequences were deposited in Genome Sequence Data Bank. Accession numbers are AF 005702-AF 005709 (for D2 regions) and AF 005710-AF 005717 (for ITS1-5.8S rDNA-ITS2 regions).

RESULTS

D2-region

Aligned data matrix of D2 region (5'-half region of 25S rRNA) comprised 572 positions. Of the 572 nucleotides sequenced, there were 15 variable positions in comparison to the NT strain of *S. cerevisiae*. The most divergent species in D2 region sequences was *S. uvarum* (13 substitutions*)*. A small number of substitutions occurred in *S. carlsbergensis* (2), *S. ellipsoideus* (2) and *S. chevalieri* (3). *S. pastorianus* and *S. bayanus* shared an equally large number of substitutions (11) (Fig.2).

A phylogenetic analysis with the Exhaustive search option of PAUP found 1 most parsimonious tree for D2 region of 89 steps (Consistency index CI-0.96, Retention index RI-0.89) (Fig.3).

The 8 strains of *Saccharomyces* are divided into 2 main clades. The first clade includes *S. pastorianus* and *S. bayanus*. The second clade includes *S. chevalieri, S. ellipsoideus, S. carlsbergensis* and *S. cerevisiae*. Both *S. paradoxus* and *S. uvarum* are segregated singly.

The 50% Majority-rule Consensus tree obtained by Kimura's "two-parameters" method is presented on Fig.4. The tree topologies

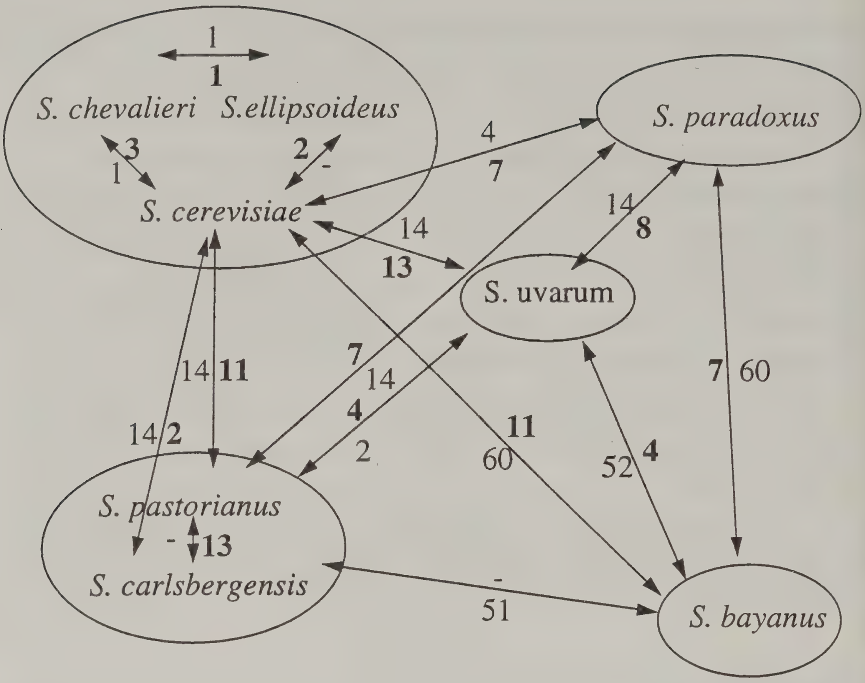
1
1
S. chevalieri
S.ellipsoideus
3
1
2
-
S. cerevisiae
4
7
S. paradoxus
14
13
14
8
S. uvarum
14
11
7
14
4
2
14
2
11
60
52
4
7
60
S. pastorianus
-
13
S. carlsbergensis
-
51
S. bayanus

Fig.2. Number of nucleotide substitutions in D2 (bold figures) and ITS1-5.8SrDNA-ITS2 (standard figures) regions of the type strains between 8 *Saccharomyces* species

obtained by parsimony and distance methods are consistent with each other.

Analyses of D2 region sequences by parsimony and distance methods allow clear separation of the species *S. uvarum, S. paradoxus, S. cerevisiae.* It was not possible to separate the species *S. carlsbergensis, S. ellipsoideus* and *S. chevalieri.* Similarly *S. bayanus* was not distant from *S. pastorianus,* as earlier demonstrated also by Kurtzman and Robnett (1991).

ITS1-5.8srDNA-ITS2 region

Aligned data matrix of ITS1-5.8SrDNA-ITS2 region comprised 510 positions. Nucleotide sequence comparison showed variability between species. *S. bayanus* was the most divergent species (60 substitutions). Other species had from 1 (*S. chevalieri*) to 14 (*S. uvarum*) substitutions (Fig.2).

The most parsimonious tree of 179 steps (CI-0.98, RI-0.94) using Exhausitive search option for ITS1-5.8S rDNA-ITS2 region is presented in Fig.5 . The strains of *Saccharomyces* form 2 clades. The first clade includes *S. chavalieri, S. cerevisiae* and *S. ellipsoideus.* The second clade includes *S. carlsbergensis S. pastorianus. S. paradoxus* and *S. uvarum* are segregated from both clades. A third clade includes the single most divergent *S. bayanus.*

The 50% Majority-rule consensus tree determined from ITS1-5.8SrDNA-ITS2 region using distance method is presented in Fig.6.

Analyses of ITS-5.8SrDNA-ITS2 region by parsimony and distanse methods allow the species *S. bayanus, S. uvarum, S. paradoxus* to be separated from *S. cerevisiae* clustered with *S. ellipsoideus* and *S. chevalieri* and from *S. pastorianus* clustered with *S. carlsbergensis.*

DISCUSSION

From our analyses of 572 nucleotides of the D2 region of 25S rRNA of 8 species of the *Saccharomyces cerevisiae* complex, it appears that the D2 region is not sufficiently variable and therefore not discriminatory enough to segregate the components of that complex as does DNA-DNA hybridization. The same lack of discrimination was observed by Kurtzman and Robnett (1991). They analysed 300 nucleotides of the D2 region, beside 300 nucleotides of another region of 25S rRNA and 300 from 18S rRNA and found only 12 substitutions within the *S. cerevisiae* complex.

Our results show that phylogenetic relationship inferred from analyses of ITS1-5.8S rDNA-ITS2 sequences correlate better than analyses of D2 region with the results obtained in DNA-DNA hybridization experiments. Indeed, the phylogenetic tree obtained from analyses of the ITS region which is more variable, demonstrates a close relationship between *S. cerevisiae, S. ellipsoideus* and *S. chevalieri* on one hand, and between *S. pastorianus* and *S. carlsbergensis* on the other, *S. bayanus*, *S. paradoxus* and *S. uvarum* being segregated apart. That confirms most of the results of DNA-DNA hybridization. In both D2 domain and ITS1-5.8SrDNA-ITS2 region analyses, *S. paradoxus* is separated from the clade of *S.*

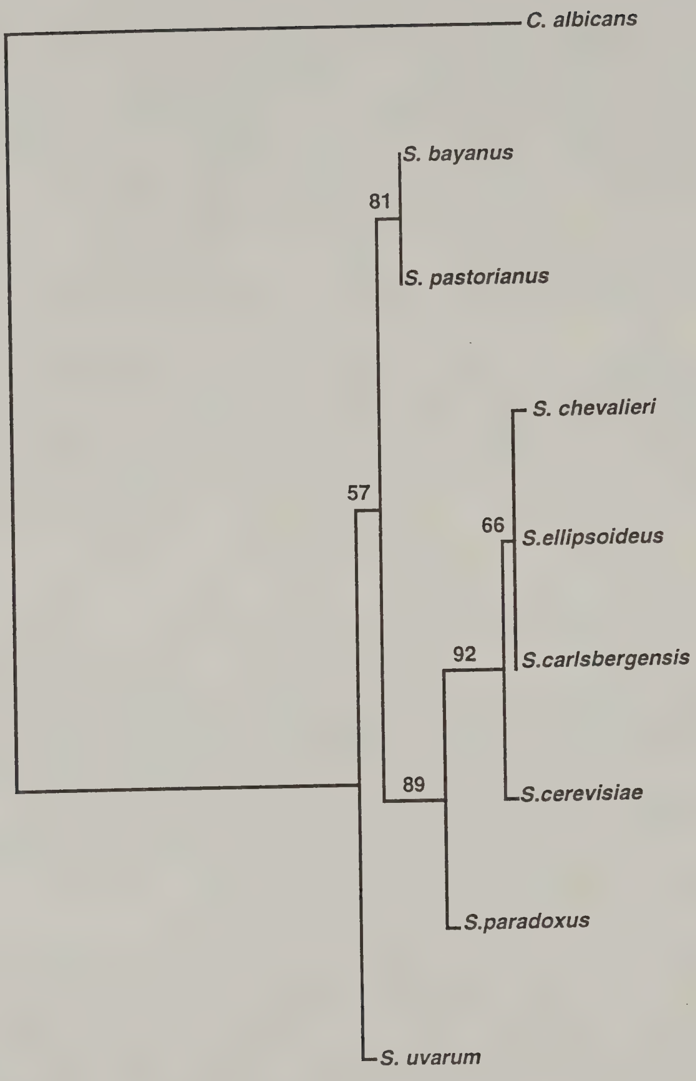
C. albicans
S. bayanus
81
S. pastorianus
S. chevalieri
57
66
S.ellipsoideus
92
S.carlsbergensis
89
S.cerevisiae
S.paradoxus
S. uvarum

Fig. 3. Phylogenetic relationships in the *Saccharomyces cerevisiae* complex of species inferred from D2 region nucleotide sequences. The phylogram presented is the most parsimonious tree (89 steps) generated from the Exhaustive search method in PAUP 3.1.1. The consistency and retention indexes of the tree are CI-0.955 and RI-0.886, respectively.

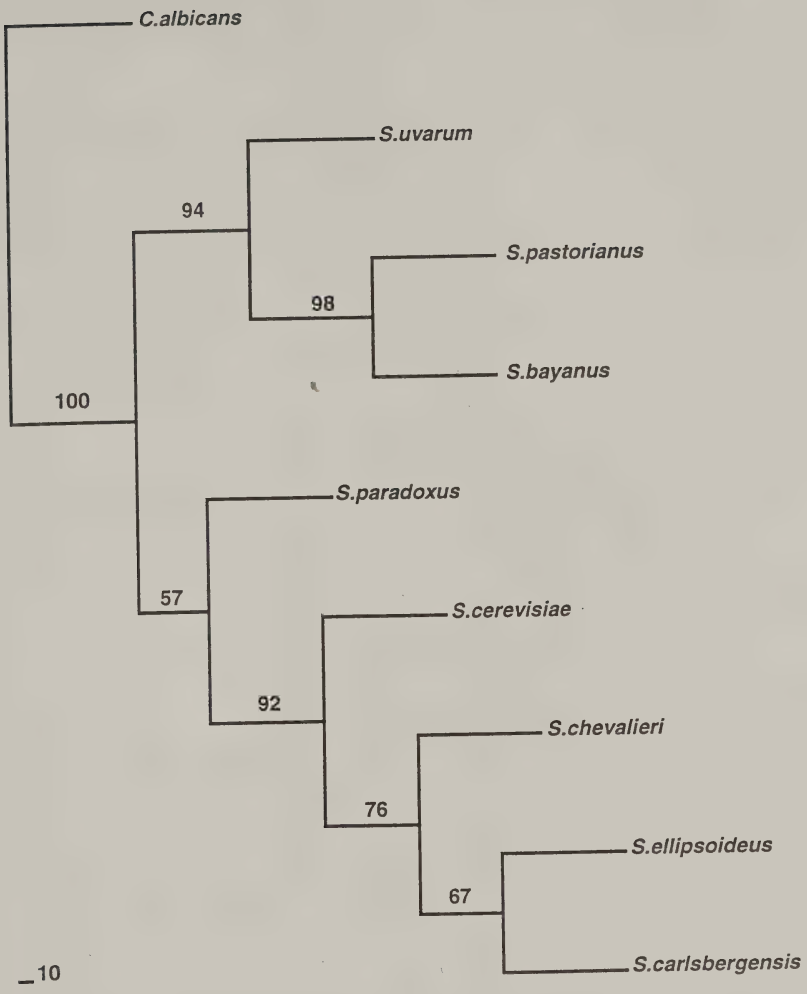
C.albicans
S.uvarum
94
S.pastorianus
98
S.bayanus
100
S.paradoxus
57
S.cerevisiae
92
S.chevalieri
76
S.ellipsoideus
67
S.carlsbergensis
10

Fig.4. 50% Majority rule consensus tree of the *Saccharomyces cerevisiae* complex of species generated from distance analysis of D2 region sequences (DNADIST method from PHYLIP package 3.57 c). The distance matrix was analysed by the UPGMA method). The percentage above the branches are the frequencies with which a given branch appears in 100 bootstrap replications.

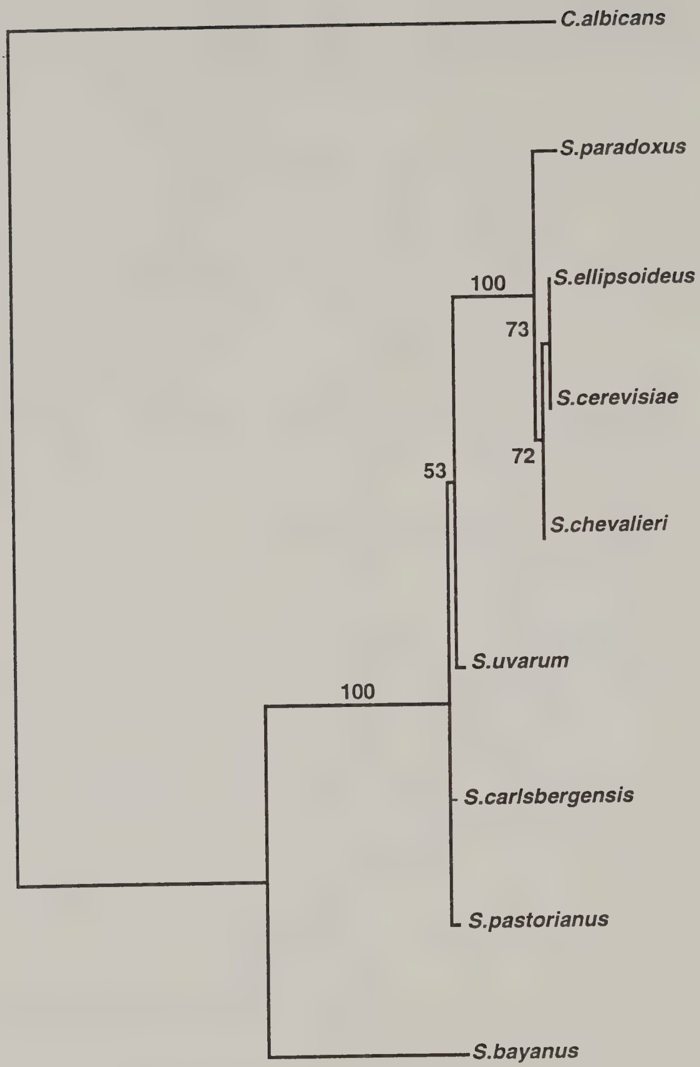
C.albicans
S.paradoxus
S.ellipsoideus
S.cerevisiae
S.chevalieri
S.uvarum
S.carlsbergensis
S.pastorianus
S.bayanus
100
73
72
53
100

Fig.5. Phylogenetic relationships in the *Saccharomyces cerevisiae* complex of species inferred from ITS1-5.8S rRNA-ITS2 nucleotide sequences. The phylogram presented is the most parsimonious tree (179 steps) generated from the Exhaustive search method in PAUP 3.1.1. The consistency and retention indexes of the tree are CI-0,983 and RI-0,943, respectively.

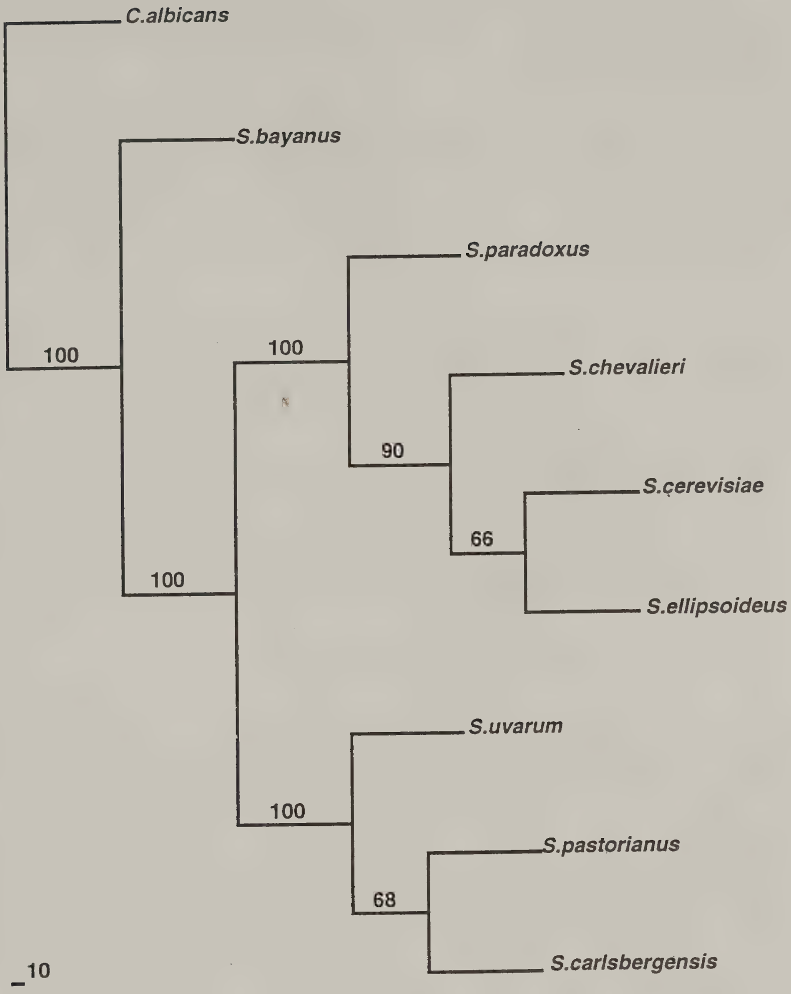
C.albicans
S.bayanus
S.paradoxus
S.chevalieri
S.çerevisiae
S.ellipsoideus
S.uvarum
S.pastorianus
S.carlsbergensis
100
100
100
90
66
100
68
10

Fig.6. 50% Majority rule consensus tree of the *Saccharomyces cerevisiae* complex of species generated from distance analysis of ITS1-5.8S rRNA-ITS2 nucleotide sequences (DNADIST method from PHYLIP package 3.57 c). The distance matrix was analysed by the UPGMA method. The percentage above the branches are the frequencies with which a given branch appears in 100 bootstrap replications.

cerevisiae and its synonyms *S. ellipsoideus* and *S. chevalieri*. *S. paradoxus* is indeed distant, but much closer than *S. bayanus,* from *S. cerevisiae* by DNA-DNA homology.

In sequence analyses of both D2 and ITS1-5.8SrDNA-ITS2 region, and by simple comparison of the number of substitutions (Fig.2) *S. bayanus* and *S. uvarum* appear to be very distant, although they are genetically close to each other from data obtained by global DNA-DNA hybridization technique.

In the parsimony tree (Fig.5) *S. uvarum* clusters as a marginal branch of *S. cerevisiae* (with *S. ellipsoideus and S. chevalieri*) and *S. paradoxus,* but with a support as weak as 53%. Whereas in the distance tree (Fig.6), it clusters with the maximum support (100%) as a marginal branch of *S. pastorianus* (syn. *S. carlsbergensis*). That indicates the closer relationship of *S. uvarum* to *S. pastorianus* than to *S. cerevisiae* and *S. chevalieri*. It is also noteworthy that *S. chevalieri* is close to *S. cerevisiae* and *S. ellipsoideus* which might confirm their synonymy but bootstrap support remains less than expected.

CONCLUSIONS

Our results, particularily those from the analyses of internal transcribed spacers region, confirm the synonymy of 1) *S. cerevisiae, S. ellipsoideus* and *S. chevalieri* and 2) *S. pastorianus and S. carlsbergensis*. Moreover they distinguish the three species *S. paradoxus*, *S. bayanus* and *S. uvarum*. Sequencing the internal transcribed spacers region appears to be a valid tool for a further study of the remaining 51 type strains available of the synonyms of *Saccharomyces cerevisiae*, in order to elucidate that complex taxonomy.

ACKNOWLEDGEMENTS

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SPHAEROTHECA FERRUGINEA ON SANGUISORBA MINOR IN TURKEY

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Sphaerotheca ferruginea on *Sanguisorba minor*, new for Turkey, is described and illustrated.

Key words: *Sphaerotheca ferruginea, Sanguisorba minor,* Turkey

In 1996 and 1997, a powdery mildew on *Sanguisorba minor*, grown as a forage crop in the Agronomy Research Farm of the Ankara University, has been observed. First symptoms on leaves, pedicels, stems and inflorescences appeared in spring. Reddish discolorations on non-distorted leaves and stems covered by white epiphytic mycelium exhibited characteristical powdery mildew symptoms. Bünyan 80 cultivar appeared to be partly resistant to this disease, compared to some other populations collected in various parts of Turkey. The collections concerned are characterized by the following microscopical features:

Conidiophores straight; conidia in chains, ellipsoid-ovoid, (26-) 32 (-40) x (12-) 15 (-20) µm (Figure 1). Cleistothecia scattered to gregarious, ca. 90 µm diam., outer peridial cells irregularly polygonal, ca. 19 µm diam, cleistothecial appendages well-developed, numerous, 1-3 times as long as the cleistothecial diam., septate, ca. 5 µm wide (Figure 2); ascus (69-)86(-111) x (52-)56(-62) µm (Figure 3); ascospores 8, (20-)27(-35) x (15-)18(-20) µm.

The causal agent of this disease has been identified as *Sphaerotheca ferruginea* (Schltdl.: Fr.) Junell, a fungus known from Europe, Asia, N. America, Balearic Island and Canary Island (Braun, 1987, 1995). *Sphaerotheca ferruginea* on *Sanguisorba minor* represents an addition to the mycoflora of Turkey.

Acknowledgement

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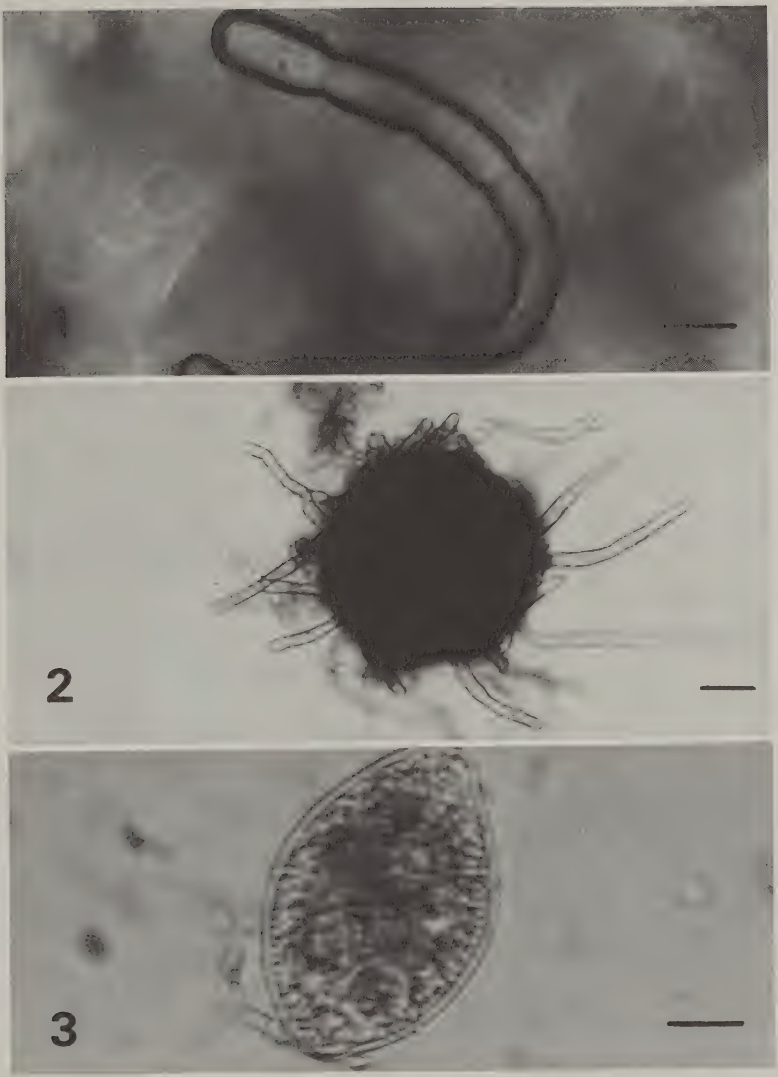

Figure 1) Conidiophore and conidia of *Sphaerotheca ferruginea* arising from the infected tissue. Figure 2) Cleistothecium and cleistothecial appandages of *Sphaerotheca ferruginea*. Figure 3) ascus and developing ascospores of *Sphaerotheca ferruginea*. Bar = 20 μm.

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LEVEILLULA TAURICA ON ONOBRYCHIS VICIIFOLIA IN TURKEY

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Leveillula taurica on *Onobrychis viciifolia*, new on this host for Turkey, is described and illustrated.

Key words: Sainfoin, *Leveillula taurica*, Turkey

Severe disease symptoms have been observed in sainfoin fields growing in the Agronomy Research Farm of the Ankara University. First symptoms, formed as white mycelium patches, appeared in early June. The causal agent of this disease has been identified as *Leveillula taurica* (Lév.) G. Arnaud (Braun, 1987, 1995). The collections concerned are characterized as follows: Mycelium on leaves, stems and inflorescences. Conidia formed singly; primary conidia very large, lanceolate; secondary ones ellipsoid to cylindrical, (32-)48(-61)x(15-)18(-25) µm (Figure 1). Ascocarps large, (128-)167(-198) µm diam., developing in early August, often immersed in the dense mycelium; peridial cells obscure, irregularly shaped; appendages mycelioid, usually shorter than the diameter of the ascomata, ca. 5 µm wide; asci numerous, (79-)102(-120)x(35-)39(-51) µm; ascospores 2 per ascus, ellipsoid-ovoid, (31-)33(-37)x(15-)18(-20) µm (Figure 2).

Leveillula taurica on *Onobrychis viciifolia* has been reported from France, Romania and Spain (Braun, 1995) as well as Iran (Sharifnabi and Banihashemi, 1990). *Onobrychis grandis* (Oran, 1974) and *O. hypargyrea* (Bremer et al., 1947) are known as host species of *Leveillula taurica* from Turkey, but *O. viciifolia* is a new host record for this country. Bremer et al. (1947) published a Turkish collection of "*Erysiphe martii*" (=*Microsphaera trifolii* (Grev.) U. Braun) on *O. viciifolia*.

Acknowledgement

The author is much obliged to Dr. U. Braun, Halle/S., Germany, for his help during the preparation of this paper.

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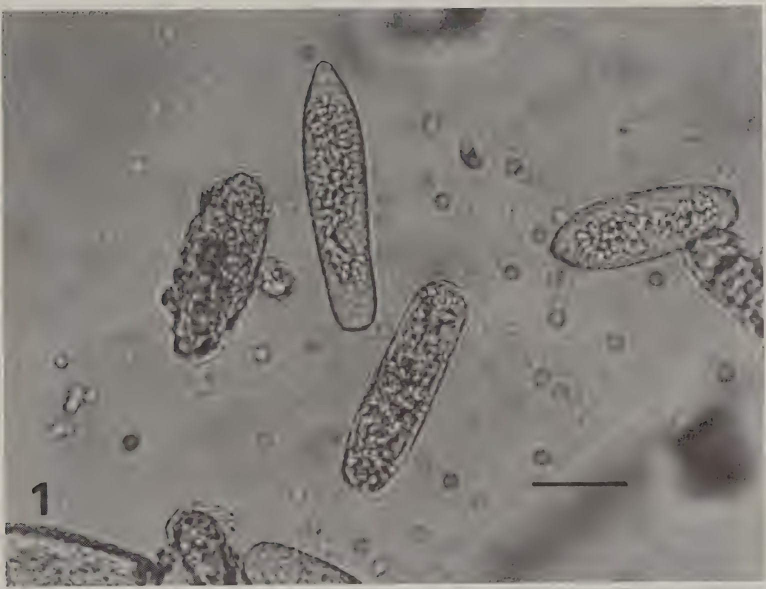

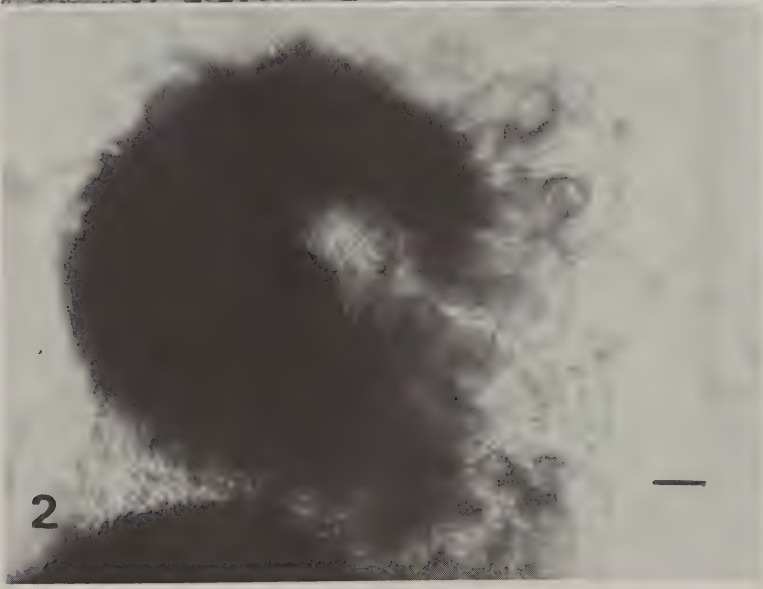

Figure 1. Conidia of *Leveillula taurica*. Figure 2. Cleistothecium, asci and ascospores of *Leveillula taurica*. Bar = 20 µm.

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STUDIES IN TROPICAL AFRICAN *LACTARIUS* SPECIES. 5. A SYNOPSIS OF THE SUBGENUS *LACTIFLUUS* (BURL.) HESLER & A.H. SM. EMEND.

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Abstract

An emendation of the subgenus *Lactifluus* (Burl.) Hesler & A.H. Sm. is proposed, based on studies from 23 African species which are classified in the sections *Rugati* (Pacioni & Lalli) Verbeken stat. nov., *Gymnocarpi* R. Heim ex Verbeken sect. nov., *Pseudogymnocarpi* Verbeken sect. nov., *Phlebonemi* R. Heim ex Verbeken sect. nov. and *Rubroviolascentes* (Singer) Verbeken stat. nov. The temperate sections *Albati* (Bat.) Singer, *Allardii* Hesler & A.H. Sm. and *Piperati* Fr. emend. Hesler & A.H. Sm. are excluded from the subgenus. A key to the species of each section is given, as well as a check-list of the African representatives of this subgenus.

1. INTRODUCTION

Resulting from an extended study of the genus *Lactarius* in tropical Africa, 78 taxa are now described and recognised from this continent (Karhula et al., 1997; Verbeken 1995a-1996d). Existing infrageneric classifications (Bon, 1983; Hesler & Smith 1979) showed to be unobliging for the tropical species. Several new sections or even subgenera will be proposed. As the structure of the pileipellis is one of the major characters used for the delimitation of subgenera and sections, and even to define certain species, a proposal for terminology and description of pileipellis-structures in the genus *Lactarius* is given here, followed by an emendation of the subgenus *Lactifluus*.

2. PILEIPELLIS-STRUCTURES IN THE GENUS *LACTARIUS*

In this study, pileipellis-structures are observed on mature basidiomes; drawings were made halfway the pileus-radius. The proposed classification is arbitrary and only points to the morphological structures without wanting to implicate an evolution between the different types. The proposal aims at unambiguous definition of observed pileipellis-structures in description of *Lactarius* species. To identify and describe a pellis-structure four basic characters have to be observed:

> a. Presence of thick-walled elements: in tropical species the presence of thick-walled and mostly hair-shaped elements is much more common than in temperate species. Elements are considered to be thick-walled when the walls measure 1 μm or more. The presence of thick-walled elements in the pellis-structure is indicated in the name of the structure by adding the prefix "lampro" (Greek: "bright, lustrous, shining", because of the refringent aspect of the walls), for example in lamprotrichoderm and lampropalisade.[1]
>
> b. Presence of isodiametric cells: a distinct layer of isodiametric cells may be present, isodiametric cells may also occur scattered in the pellis-structure or they may be totally absent. The scattered occurrence of isodiametric cells is often due to the inflation of parts of hyphae. A distinct layer of isodiametric cells is mostly basal, but in some cases the whole pileipellis consists of isodiametric cells.
>
> c. Orientation of the terminal elements: the upper layer of the pellis consists of cylindrical terminal elements or just hyphae (in case of a filamentous pellis sensu Bon), these may be arranged periclinic, anticlinic or obliquely in relation to the underlying surface.
>
> d. Presence of a slime-layer: especially in the case of a cutis or trichoderm the hyphae may secrete slime or the walls become gelatinized which results in a visible slime-layer embedding the upper layer. In one African species (*Lactarius sulcatulus* Verbeken) a hymeniderm is covered by a very thin and well-delimited slime-layer. In another species, *Lactarius undulatus* Verbeken, the underlayer has a slimy appearance. As such structures are only observed in one species, no special name is given to them.

The combination of these four characters leads to the following types, between which intermediate forms may of course occur. Though pellis-structures vary within one species with the age of the basidiome and the position on the pileus of stipe, this variation is limited and stays within the range of one type.

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[1] In most cases the thick-walled elements form an entire upper layer, but there are some particular cases where they only occur scattered in a pileipellis-structure consisting of thin-walled elements, I call this latter type "mixed"; it is observed in the subgenus *Lactariopsis* and in the genus *Pleurogala* - see Studies in tropical African *Lactarius* species. 6.

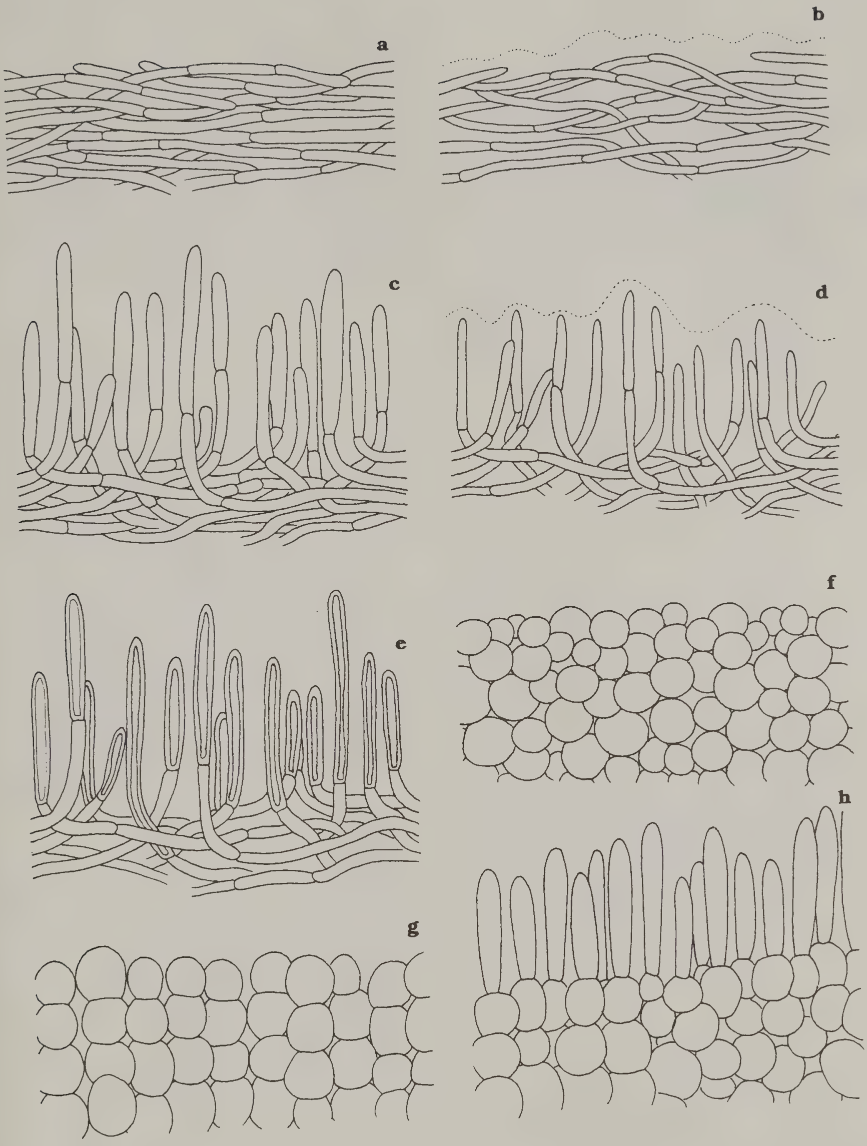

Fig. 1. Pileipellis-structures (schematic). a. cutis, b. ixocutis, c. trichoderm, d. ixotrichoderm, e. lamprotrichoderm, f. irregular epithelium, g. regular epithelium, h. palisade.

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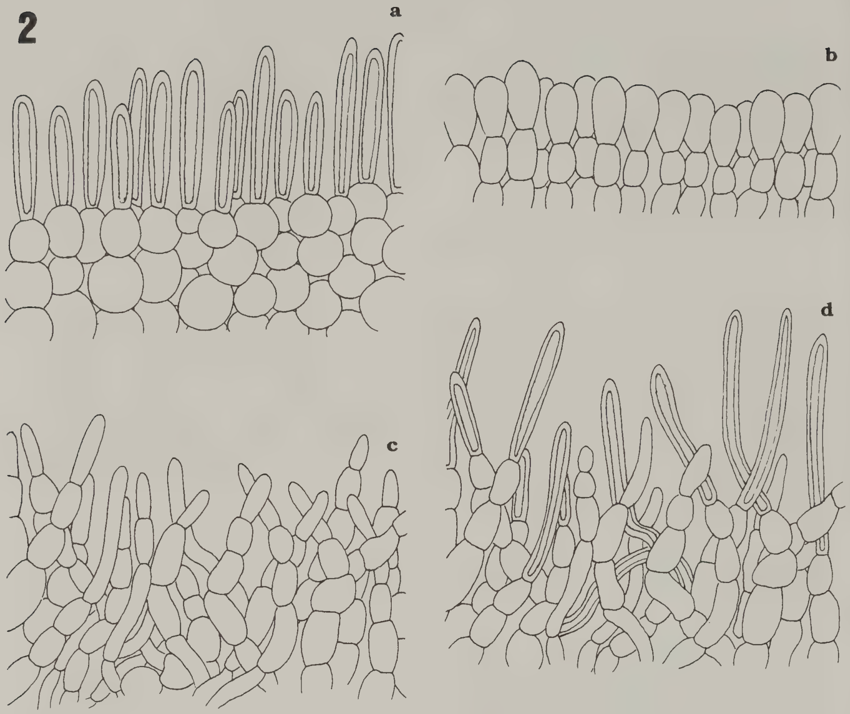

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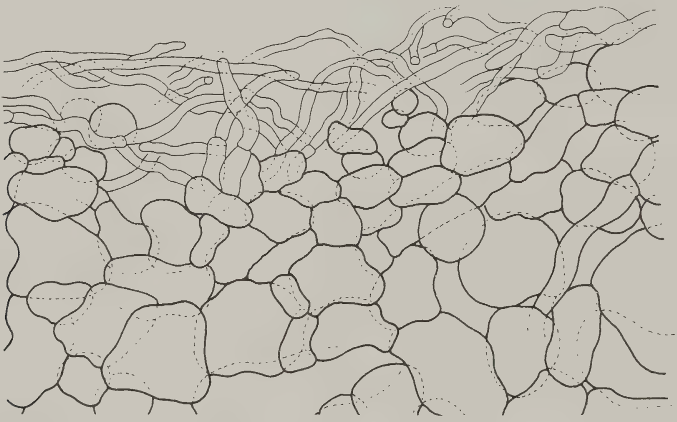

Fig. 2. Pileipellis-structures (schematic). a. lampropalisade, b. hymeniderm, c. trichopalisade, d. lamprotrichopalisade. Fig. 3. Pileipellis of *Lactarius piperatus*.

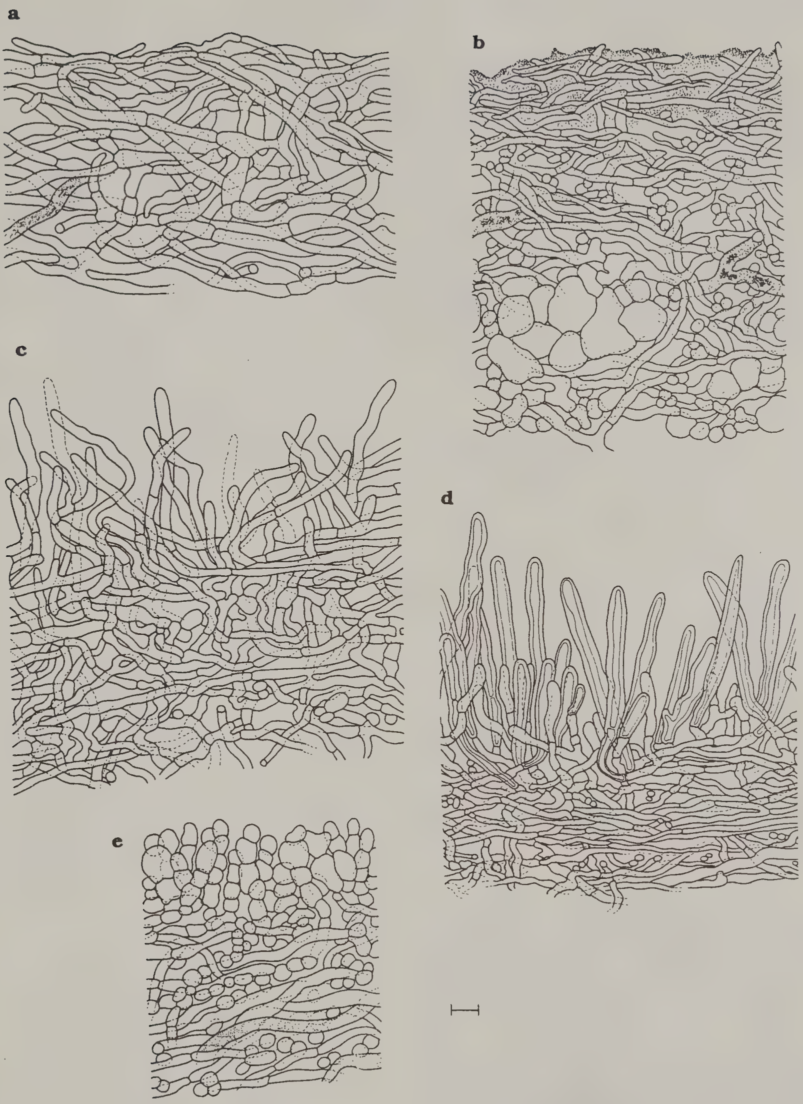

Fig. 4. Pileipellis-structures. a. cutis (*Lactarius cyanovirescens*), b. ixocutis (*L. chromospermus*), c. trichoderm (*L. aurantiifolius*), d. lamprotrichoderm (*L. denigricans*), e. regular epithelium (*L. adhaerens*) (scale bar = 10 µm).

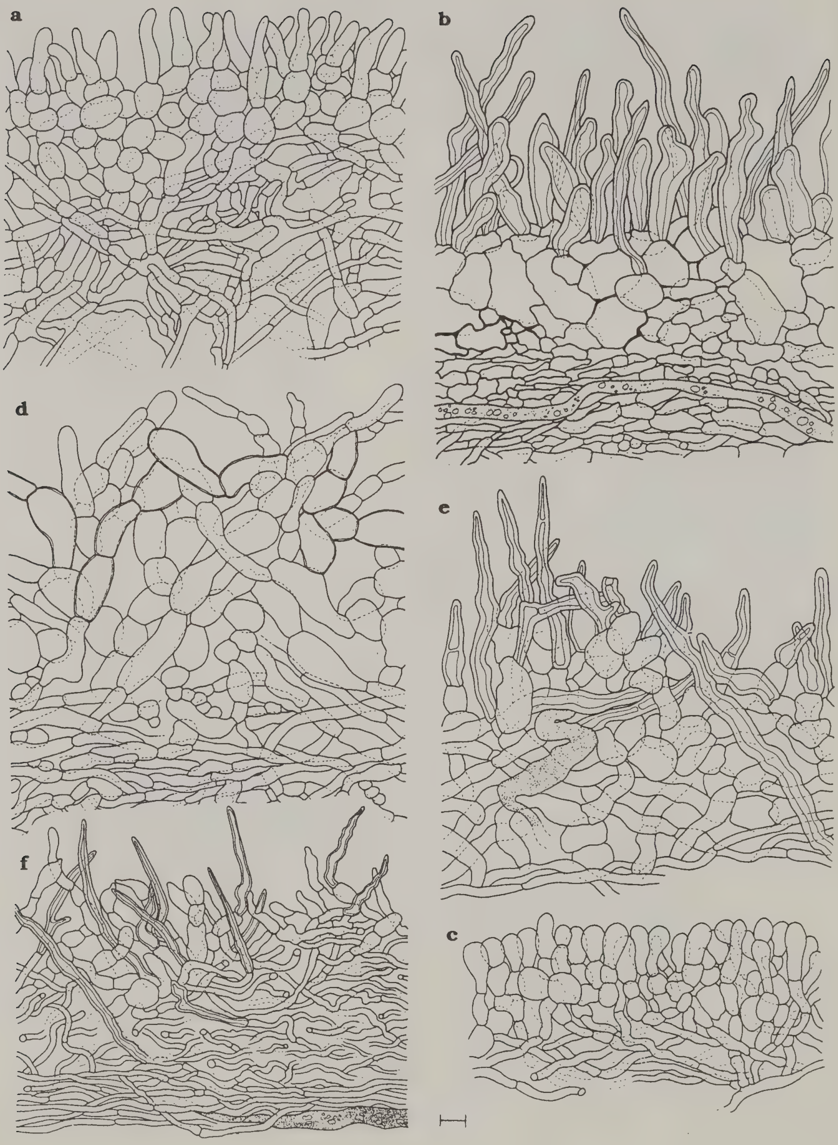

Fig. 5. Pileipellis-structures. a palisade (*Lactarius griseogalus*), b. lampropalisade (*L. gymnocarpus*), c. hymeniderm (*L. melanogalus*), d. trichopalisade (*L. edulis*), e. lamprotrichopalisade (*L. pelliculatus*), f. mixed type (*L. sesemotani*)
(scale bar = 10 μm).

* Pellis without inflated elements or sphaerocytes, composed entirely of filamentous elements:

a. **cutis**: the upper layer consists of mostly hyaline and thin-walled hyphae which are pericline, recumbent and parallel or slightly intermixed. Sometimes the only difference with the underlying pileustrama is a more dense and compact structure of the pellis. Differentiated structures are mostly lacking, although pileocystidia with a special shape or content may occur (fig. 1a, 4a).

b. **ixocutis**: the hyphae of the cutis may secrete slime or the walls of the hyphae gelatinize, in dried material it is impossible to detect which of the two processes occurred, maybe they even occurred together; this results in a slime layer wherein parallel, very thin and hyaline hyphae are visible (fig. 1b, 4b).

c. **trichoderm**: the pellis consists of mostly hyaline and thin-walled hyphae, but at least part of them are ascending and then anticline or oblique; in the most typical case all terminal elements are anticline and form a dense turf of "hairs" (fig. 1c, 4c).

d. **ixotrichoderm**: same structure as a trichoderm but the hyphae are gelatinized or secrete slime, which results in being embedded in a slime-layer (fig. 1d).

e. **lamprotrichoderm**: the ascending, anticline terminal elements are clearly differentiated and thick-walled (fig. 1e, 4d).

* Pellis with a distinct layer of inflated elements or sphaerocytes:

f. **irregular epithelium**: cellular structure, pseudoparenchymatic structure, the upper layer is completely composed of isodiametric cells, which are irregularly ordered (fig. 1f).

g. **regular epithelium**: subcellular structure, pseudoparenchymatic structure, the upper layer is completely composed of isodiametric (or almost isodiametric) cells; these cells are not irregularly ordered, but more or less arranged in anticline rows (fig. 1g, 4e).

h. **palisade**: consists of an upperlayer of anticline, elongated, hair-shaped elements and an underlying dense and compact layer of isodiametric cells (fig. 1h, 5a).

i. **lampropalisade**: a palisade with thick-walled terminal elements (fig. 2a, 5b).

j. **hymeniderm**: special case of palisade where the terminal elements are not elongate and septate (as is often the case in a palisade) but clavate; the underlying layer of isodiametric cells is often rather thin, the whole structure reminding thus somewhat a hymenium (fig. 2b, 5c).

* Pellis with isodiametric cells or sphaerocytes, but these never forming a distinct layer:

k. **trichopalisade**: between a trichoderm and a real palisade; this may look like a trichoderm where parts of the ascending, anticline hyphae are inflated or almost rounded; it may also be a structure where some of the terminal elements are ascending from isodiametric cells, others are ascending from hyphae (fig. 2c, 5d).

l. **lamprotrichopalisade**: a trichopalisade where the terminal elements have thickened walls (fig. 2d, 5e).

The presence of thick-walled elements, the anticline orientation of terminal elements and the presence of a distinct layer of isodiametric cells are considered as primitive characters, which makes the lampropalisade a supposed primitive structure, and leaves the cutis as very evolved. A lampropalisade may lead to a lamprotrichopalisade and lamprotrichoderm in one way, and to a palisade in another way. Both could have lead to trichoderms and cutis-like structures. The cellular structure seems a particular case of a palisade. True dermatocystidia are especially observed in cutis-structures, which makes them also to be considered as evolved structures.

Extracellular pigmentation and incrustations, certainly need to be observed on fresh material. The intracellular pigmentation is visible over a longer period, even in older exsiccata. Many of the African species, especially of the subgenus *Plinthogalus*, have intracellular pigmentation in the pileipellis: the elements of the upper layer have a remarkable brownish content. Extracellular pigmentation was only observed in the pileipellis of *L. arsenei* R. Heim.

3. A NEW DEFINITION OF THE SUBGENUS *LACTIFLUUS*

Lactarius subgenus *Lactifluus* (Burl.) Hesler & A.H. Sm., N. Amer. Species Lactarius: 158 (1979), emend.

Pileus firm, fleshy, mostly thick, compact; pileipellis mat, dry and velvety, sometimes subtomentose, cracked or with veines, never shiny or viscid, orange, yellowish ochraceous, pale brown, reddish brown or orange brown. Lamellae (very) distant or crowded, white, pale to yellowish orange, often staining brown. Stipe solid, firm, rarely fistulous, mostly concolorous or paler. Context white, unchanging or changing brown, firm and compact, mostly staining greenish or pinkish with $FeSO_4$;

taste mostly mild; smell often fish-like. Latex abundant, white, unchanging or changing brownish or purplish, sometimes staining context brown. Spores ellipsoid to elongate (sometimes subglobose), typically lowly ornamented with an incomplete to almost complete or complete reticulum or with isolated warts; plage often with central amyloid spot. True cystidia absent or present and then in form of mostly abundant and emergent lamprocystidia. Pileipellis a palisade or lampropalisade.

Type: *Lactarius volemus* (Fr.: Fr.) Fr.

discussion

Besides the section *Lactifluus*, Hesler & Smith (1979) included in this subgenus also the sections *Allardii* Hesler & A.H. Sm., *Albati* (Bat.) Singer and *Piperati* Fr. emend. Hesler & A.H. Sm.

They defined the section *Allardii* as characterized by a pileipellis lacking a basal cellular layer. I consider the palisade or palisade-like structure of the pileipellis as a main character of the subgenus and therefore it is presumed that the species of the section *Allardii* do not belong to the subgenus *Lactifluus*. I exclude the sections *Albati* and *Piperati* from this subgenus. *Lactarius vellereus* (Fr.: Fr.) Fr. has a lamprotrichoderm-structure as pileipellis (Verbeken & Vesterholt, 1997). The pileipellisstructure of *L. piperatus* (Scop.: Fr.) Pers. is depicted in fig. 3 and although there is a distinct layer of isodiametric cells, there is no palisade, because the upper layer consists of periclinic, repent hyphae and reminds a cutis-structure.

Further study may reveal whether the neotropical section *Polysphaerophorini* Singer ought to be included in this subgenus.

key to the sections

1. True pleurocystidia present, abundant, emergent, cylindrical or lanceolate, slightly to very thick-walled 2

True pleurocystidia absent 4

2. Spores extremely lowly ornamented to almost smooth; plage not amyloid; pileipellis-structure a palisade with slightly thick-walled and irregularly tortuous elements; elements at the base of the stipe with a globose, swollen apex . . . . sect. **Rubroviolascentes**

Not with those characters 3

3. Spores globose to subglobose, with reticulate ornamentation; plage inamyloid; context greenish with $FeSO_4$ . . . . . sect. **Lactifluus** (extraterritorial)

Spores elongate, ornamented with a low complete to incomplete reticulum; plage often with a central amyloid spot; context salmon pinkish to orange with $FeSO_4$ . . . . sect. **Pseudogymnocarpi**

4. Spore-ornamentation typically composed of almost isolated, rounded warts, never an incomplete reticulum; latex immediately changing brown; smell fish-like; context not, or slightly, changing with $FeSO_4$; hymenophoral trama mainly composed of narrow hyphae; sphaerocytes, if present, small and never dominant . . . . sect. **Phlebonemi**

Spore-ornamentation composed of an incomplete to complete reticulum; context changing with $FeSO_4$; hymenophoral trama mainly composed of sphaerocytes 5

5. Pileus strongly veined; very thick-walled elements in the pileipellis, sometimes very irregularly shaped, suprapellis thicker than the subpellis; context greenish with $FeSO_4$ . . . . sect. **Gymnocarpi**

Pileus sometimes veined, buth rather felty and cracked; elements in the pileipellis thin-walled or slightly thick-walled, cylindrical and regular; subpellis thicker than the suprapellis; context pinkish with $FeSO_4$ . . . . sect. **Rugati**

3.1. section *Rugati* (Pacioni & Lalli) Verbeken stat. nov.

basionym: sect. *Lactifluus* subsect. *Rugati* Pacioni & Lalli, Mycotaxon 44: 190 (1992).
syn.: sect. *Russularia* Fr. group *Lactifluae* Burl. pro parte, Mem. Torrey Bot. Club 14: 89 (1908); sect. *Pruinosi* Quel. group *Volemi* Konrad pro parte, Bull. Trimestriel Soc. Mycol. France 51: 190 (1935); sect. *Lactifluus* (Burl.) Hesler & A.H. Sm. stirps *Hygrophoroides*, N. Amer. Species Lactarius: 169 (1979, nom. nud.).

Pileus medium to medium-large sized, firm, fleshy, thick; pellis mat, dry, tomentose-granular, with brownish orange, red and reddish brown colours. Lamellae moderately spaced to very distant, thick, yellowish to orange; edge entire, concolorous. Stipe central, cylindrical, slightly tapering downwards, firm, dry, tomentose, solid, more or less concolorous with pileus. Context white, unchanging, firm, often staining green or grey with $FeSO_4$; taste mild. Latex abundant, white to watery, unchanging, sometimes drying greyish or brown. Spores ellipsoid to elongate, verrucose or with a more or less complete reticulum; plage sometimes with central amyloid spot. True pleurocystidia absent. Hymenophoral trama composed of sphaerocytes and abundant lactifers. Pileipellis a palisade; subpellis mostly thicker than the subpellis; terminal elements very slightly thick-walled. Distribution subcosmopolitic.

Type: *Lactarius rugatus* Kühner & Romagn.

discussion

A historical review of the systematic position of *Lactarius volemus* (Fr.: Fr.) Fr. and related species is given by Lalli & Pacioni (1992). Hesler & Smith (1979) proposed the subgenus *Lactifluus*, and established section *Lactifluus* as one of its four sections, including 11 taxa. In this section the pileus is coloured (yellow, orange or red series) and a layer of inflated cells is present in the pileipellis; the pileus is dry, velutinate to unpolished. Lalli & Pacioni (1992) thoroughly reviewed the section *Lactifluus* on a world-wide basis, giving a well delimited description. As a consequence, they subdivided it into three subsections:

- subsection *Volemi*, consisting of species which have globose to subglobose, reticulate spores and numerous and obvious, lanceolate and very thick-walled cystidia;

- subsection *Luteoli*, characterized by elongated spores, ornamented with isolated spines or warts. The colours are generally light, off-white to yellowish or ochre, rarely with some shade of brown;

- subsection *Rugati*, with species also having elongated spores, with the ornamentation consisting of an almost complete reticulum. The colour pattern is orange-brown, often with some shade of brick-red.

Lalli & Pacioni accepted 12 taxa besides 5 doubtful entities. They excluded *Lactarius pseudovolemus* R. Heim on the basis of the unchangeable context, the slightly bitter taste and the structure of the pileipellis. The context not always shows a colour-change in this section (e.g. *Lactarius subvelutinus* Peck, *L. hygrophoroides* Berk. & M.A. Curtis). I do not consider the taste as a character important enough to exclude the species (besides, the taste in *Lactarius echinatus* Thiers is said to be acrid, disagreeable; mild or astringent in *L. corrugis* Peck). The structure of the pileipellis of *Lactarius pseudovolemus* R. Heim is not similar to the drawing of Lalli & Pacioni, which probably representes *L. annulatoangustifolius* (Beeli) Buyck, because I traced a collection of the latter at PC with the same number as the type of *L. pseudovolemus*.

I consider the differences between those subsections important enough to classify them as sections. I propose the section *Lactifluus* with *Lactarius volemus* as type-species and the section *Rugati* typified by *Lactarius rugatus*. I was not able yet to study any of the representatives of the subsection *Luteoli* but it is clear that this should be done together with a study of the section *Polysphaerophorini* Singer.

Our material contains 5 tropical African members of the section *Rugati*. An important character of this section is the absence of true pleurocystidia, which was not observed by Lalli & Pacioni (1992) as they did not make a distinction between pseudocystidia and true cystidia. Furthermore, the African species in this section have typical long and slender basidia and a often small, but distinct central amyloid spot on the plage. Those characters occur also in the temperate species *Lactarius rugatus* and *L. hygrophoroides*.

key to the species

1. Pileipellis finely tomentose-granular, not veined or at most wrinkled; stipe short and slender (2-3.5 cm long); spores with inamyloid plage 2

   Pileipellis finely veined and wrinkled; stipe longer (3-8 cm); at least some spores with a centrally amyloid plage 3

2. Stipe with tough mycelium at the base; lamellae orange; basidia 45-50 × 8-9 μm; terminal elements of pileipellis 20-40(50) μm long and slightly thick-walled . . . . **L. pseudovolemus**

   Stipe without mycelium at the base; lamellae white to cream-coloured; basidia 55-90 × 9-11 μm; terminal elements of the pileipellis 10-75 μm long with walls up to 1(2) μm thick . . . . **L. volemoides**

3. Pileus orange-red to brown; spores 9.1-9.4 × 6.6-6.9 μm; warts small, mostly elongate and up to 0.1 μm high; elements of stipitipellis (20)50-100 × 4-6 μm, thick-walled, extremely long and tortuous at the base of the stipe . . . . **L. rubiginosus**

   Pileus dark brown when young, then paler and more reddish, sometimes with ochraceous spots; spores smaller, 7.9-8.4 × 5.9-6.3 μm, warts more rounded, up to 0.2 μm high; elements of the stipitipellis 10-40 × 2-4 μm, thin-walled, only thick-walled at the base . . . . **L. kivuensis**

3.2. section *Gymnocarpi* R. Heim ex Verbeken sect. nov.

syn.: sect. *Caperati* R. Heim "groupe" *Gymnocarpi* R. Heim, Bull. Jard. Bot. Etat 25: 24 (1955, descr. gall.).

Basidiomata vivide colorata, flavido-aurantiaca, brunneo-aurantiaca vel aurantiaca. Lamellae decurrentes, distantes, crassae; pallide flavae ad cremeae. Sporae incomplete reticulatae, cristis et verrucosis demississimis ornatae; macula suprahilaris maximam partem centrale amyloidea. Pleurocystidia absentia. Pileipellis bistrata;

elementa suprapellis longa, cylindrata et trichoidea, vel irregulares, pariete incrassato; subpellis pseudoparenchymata. Trama lamellae heteromera.

Typus: *Lactarius gymnocarpus* R. Heim ex Singer.

Pileus firm, soon depressed and infundibuliform; pellis dry, wrinkled, often strongly veined, orange, brownish orange or ochraceous. Lamellae decurrent, thick, distant, cream-colour or pale yellow, with brown spots or staining brown. Stipe firm, solid, concolorous. Context white, firm, locally staining brown, green or greyish green with $FeSO_4$; taste mostly mild; smell *Valeriana*-like, *Russula xerampelina*-like. Latex white, unchanging or drying ochraceous brown. Spores ellipsoid; ornamentation low, composed of irregular warts and ridges, forming an incomplete reticulum; plage with or without central amyloid spot. True pleurocystidia absent. Lamella-edge sterile. Hymenophoral trama composed of sphaerocytes. Pileipellis a lampropalisade; elements of the suprapellis thick-walled, cylindrical or irregularly shaped, often branched; suprapellis thicker than the subpellis.

Type: *Lactarius gymnocarpus* R. Heim ex Singer.

discussion

Heim (1943) first included *Lactarius gymnocarpus* in the subgenus *Lactariopsis* (Henn.) R. Heim, because of the similar aspect of the pileipellis, similar pleurocystidia and the comparable spore-ornamentation. Singer (1946) considered his section *Lactariopsidei* (Henn.) Singer in the same way and also included *L. gymnocarpus*. However, the pseudocystidia in *Lactarius gymnocarpus* are different from the emergent and fusiform pseudocystidia observed in the *Lactariopsidei* and the pileipellis-structures of both groups belong to different types (Verbeken 1995b, 1996a). In his later revision, Heim (1955) put the species in his section *Caperati*, in which he recognized three groups: *Lactariopsis*, *Phlebonemi* and *Gymnocarpi*; the latter consisting of *L. gymnocarpus* and the invalidly described *L. cinnamomeus* R. Heim. I exclude the latter (a synonym of *L. latifolius* Gooss.-Font. & R. Heim) because of its different pileipellis-structure: a trichopalisade and not a lampropalisade, as observed in the section *Gymnocarpi*.

In my study of *Lactarius gymnocarpus* and related species (Verbeken, 1995) I described some species which all show remarkable resemblances with *Lactarius gymnocarpus*. However, some of them are now placed in a separate section, because of the presence of true pleurocystidia and the more regular, less thick-walled elements of the pileipellis.

The smell, the taste, the reaction of the context with $FeSO_4$ and the brown staining of the lamellae and the context are characters which need to be checked in several species.

key to the species

1. Suprapellis of the pileipellis composed of spherical to cylindrical, often irregularly shaped elements; terminal elements 5-15 µm wide, often branched 2

   Suprapellis of the pileipellis composed of cylindrical, narrow elements; terminal elements less than 10 µm wide 3

2. Elements from the suprapellis of the pileipellis often 15 µm broad; lamellae very spaced, 2-5 L+l/cm; stipe yellowish orange to golden yellow . . . . **L. gymnocarpus**

   Elements from the suprapellis of the pileipellis up to 10 µm broad; lamellae slightly denser, 5-8 L+l/cm; stipe white . . . . **L. tanzanicus**

3. Spores ellipsoid, 7.3-8.4 × 5.5-6.0 µm; average Q = 1.20-1.50 . . . . **L. flammans**

   Spores elongate, 8.2-10.3 × 5.2-6.3 µm; average Q = 1.40-1.75 . . . . **L. goossensiae**

3.3. section *Pseudogymnocarpi* Verbeken sect. nov.

Pileus parvus ad mediocris, leviter velutinus, rimosus ad rugosus, griseo-aurantiacus ad aurantiacus. Lamellae decurrentes, distantes, crassae; albidae ad flavae. Sporae ellipsoideae ad elongatae, incomplete vel complete reticulatae; macula suprahilaris maximam partem centrale amyloidea. Pleurocystidia abundantia, emergentia, cylindrata ad fusiformia. Pileipellis bistrata; elementa suprapellis longa, cylindrata et trichoidea; subpellis pseudoparenchymata. Trama lamellae heteromera.

Typus: *Lactarius gymnocarpoides* Verbeken.

Pileus small to medium-sized, firm or fragile; pellis dry, velvety, cracking or slightly wrinkled, greyish orange to bright orange, sometimes yellowish orange. Lamellae decurrent, thick, distant, white, cream-colour, pale yellow or greenish yellow. Stipe rather fragile, often becoming chambered or fistulous, white, pale yellow or bright to even greenish yellow. Context white to cream-colour (seldom changing reddish, then black), salmon pinkish with $FeSO_4$; taste mild (or bitter); smell mostly remarkable. Latex not abundant, white, mostly unchanging. Spores ellipsoid to elongate; ornamentation low, composed of an incomplete to complete reticulum, isolated warts and ridges scarce; plage with or without central amyloid spot. True pleurocystidia mostly abundant and emergent, cylindrical to fusiform, mostly lamprocystidia. Lamella-edge sterile or fertile. Hymenophoral trama composed of sphaerocytes. Pileipellis a lampropalisade; elements of the suprapellis thin-walled or slightly thick-walled, cylindrical and regular, suprapellis thicker than the subpellis.

Type: *Lactarius gymnocarpoides* Verbeken.

key to the species

1. True pleurocystidia abundant and emergent, often lamprocystidia 2

   True pleurocystidia present but inconspicuous, not emergent; basidiomes small and slender; stipe and lamellae remarkably yellow to greenish yellow . . . . **L. luteopus**

2. Context becoming red, then lilac and finally black by the latex; latex transparently whitish, changing red when exposed, finally black . . . . **L. denigricans**

   Context unchanging; latex unchanging or changing violet when drying . . 3

3. Pileus conspicuously whitish pruinose; latex changing violet; elements of the pileipellis extremely elongate, up to 300 μm long . . . . . **L. medusae**

   Pileus not whitish pruinose; latex mostly unchanging; elements of the pileipellis up to 100 μm long 4

4. Stipe white; spores elongate (average Q = 1.33-1.60) . . . . **L. longisporus**

   Stipe pale orange to pale yellow; spores ellipsoid (average Q = 1.17-1.29) 5

5. Lamella-edge fertile; ornamentation of the spores composed of an incomplete reticulum without distinct warts . . . . **L. gymnocarpoides**

   Lamella-edge sterile; ornamentation of the spores composed of a partial reticulum and some isolated warts 6

6. Stipitipellis a lampropalisade, composed of elements with clearly thickened walls; hymenophoral trama composed of sphaerocytes . . . . **L. pseudogymnocarpus**

   Stipitipellis a trichoderm, no thick-walled elements present; hymenophoral trama composed of hyphae . . . . **L. pumilus**

3.4. section *Phlebonemi* R. Heim ex Verbeken sect. nov.

syn.: sect. *Caperati* R. Heim "groupe" *Phlebonemi* R. Heim, Bull. Jard. Bot. Etat 25: 35 (1955, descr. gall.).

Basidiomata rugosa ad venosa, pallide brunnea, flavido-ochracea vel fusca. Lamellae adnatae ad decurrentes, confertae vel confertissimae, albae, cremeae, brunneo-flavidae, saepe brunnescentes. Contextus brunnescens, odore saepe piscis similis. Latex albus, brunnescens. Sporae elipsoideae, interdum subglobosae, verrucosis demississimis isolatisque ornatae. Pleurocystidia absentia. Pileipellis bistrata; elementa suprapellis longa, cylindrata et trichoidea, pariete leviter incrassato; subpellis pseudoparenchymata. Trama lamellae ex hyphis composita.

Typus: *Lactarius phlebonemus* R. Heim & Gooss.-Font.

Pileus medium-sized to large, seldom small, firm, fleshy, convex to applanate and slightly depressed, sometimes infundibuliform; pellis mat, dry, sometimes felty, slightly wrinkling to wrinkling or with remarkable veins, pale beige, yellowish ochre to dark brown. Lamellae adnate to decurrent, crowded to very crowded, white, cream-colour, brownish yellow or becoming dark brown. Stipe firm, cylindrical to subcylindic, slightly felty, sometimes longitudinally wrinkled to grooved. Context whitish, becoming brownish or brown; smell mostly fish-like. Latex abundant, white, changing to dark brown. Spores mostly ellipsoid, sometimes subglobose; ornamentation not exceeding 0.5 μm, composed of regularly or irregularly shaped warts, mostly isolated, sometimes connected. True pleurocystidia absent. Hymenophoral trama composed of hyphae. Pileipellis a lampropalisade or palisade with slightly thickened elements, sometimes locally a lamprotrichoderm with inflated elements at the base.

Type: *Lactarius phlebonemus* R. Heim & Gooss.-Font.

discussion

When Heim described *Lactarius phlebonemus* (1955), he placed the species in his section *Caperati*, because of the veined aspect of the pileus and the lowly ornamented spores. The section *Caperati* contained three groups: *Lactariopsis*, *Gymnocarpi* and *Phlebonemi*, the latter characterized by its whitish, ochraceous or brownish latex, its concolorous pileus and stipe, the very crowded lamellae and the thick and fleshy context.

Lactarius angustus R. Heim & Gooss.-Font. was included by Heim in the group *Volemi*. Lalli & Pacioni (1992) did not study the material, but proposed to exclude it from the section *Lactifluus* because of the acrid latex and the different spore-ornamentation. The dense lamellae, the thick-walled elements in the pileipellis, the typical spore-ornamentation and structure of the hymenophoral trama argue indeed for placing this species in the section *Phlebonemi*, and not in the section *Lactifluus*. *Lactarius brunnescens* Verbeken and *L. nonpiscis* Verbeken are two species described from miombo woodland. *Lactarius brunnescens* has not the typical spore-ornamentation for this group (isolated warts), but all other characters are very similar to those of *L. phlebonemus*.

Some insufficiently known species are added here as doubtful members of this section. Heim described *Lactarius caperatus* R. Heim & Gooss.-Font. in the group *Phlebonemi* as closely related to *L. phlebonemus* because of the same pileipellis-structure, the same spore-ornamentation, composed of regular and conical warts, almost always isolated; although the latex or context are not changing. Unfortunately, the microscopic characters of this species could not be checked, as the cited specimens, *Goossens-Fontana* 4038 and 4078 are lost. The type-material of *Lactarius arsenei* R. Heim consists of only one basidiome in bad condition. Nevertheless, the microscopic characters could be observed. The species shares the same pileipellis-structure and the same type of spore-ornamentation as *Lactarius phlebonemus*; the lamellae are also very narrow and crowded; only the latex and context are described as unchangeable making its position in the *Phlebonemi* not fully certain. Another insufficiently known species described from Madagascar is *Lactarius pisciodorus* R. Heim. Heim considered this species to be closely related to *Lactarius amarus* R. Heim, especially by the zonate aspect of the pileus. The microscopic characters of the type-specimen were difficult to observe as the material is in extremely bad condition, nevertheless, a certain relationship with the *Phlebonemi* is supposed on the base of the spore-ornamentation (which is very different from *Lactarius amarus*) and the presence of thick-walled extremities in the pileipellis. *Lactarius pisciodorus*, *L. arsenei* and *L. nonpiscis* share the fish-like smell.

key to the species

1. Elements of the pileipellis capitate, spherical at the apex . . . **L. nonpiscis**

Elements of the pileipellis not capitate 2

2. Spore-ornamentation composed of conical to subconical warts, 0.5 μm high, isolated, seldom connected by fine connective lines 3

Spore-ornamentation composed of small irregular warts, 0.2 μm high, aligned or connected by fine connective lines . . . . **L. brunnescens**

3. Basidiomes small (about 4 cm diam.); smell fish-like; extracellular brown pigmentation present in the subpellis of the pileipellis . . . **L. arsenei**

Basidiomes larger; smell not remarkable; without extracellular pigmentation in the subpellis of the pileipellis 4

4. Pileus with remarkable gelified sinuose veins, very strongly wrinkling, yellow ochre with orange centre to brownish ochre or dark brown; latex changing

ochre to light brown, then dark brown; connective lines in the spore-ornamentation rare, although present in almost every spore
. . . . **L. phlebonemus**

Pileus without veins, almost smooth, felty, vivid ochraceous orange; latex white, unchanging, context changing brown; connective lines in the spore-ornamentation very rare, present in only a few spores
. . . . **L. angustus**

Insufficiently known species: *L. caperatus*, *L. pisciodorus*.

3.5. section *Rubroviolascentes* (Singer) Verbeken stat. nov.

basionym: sect. *Dulces* R. Heim ex Singer subsect. *Rubroviolascentini* Singer, Ann. Mycol. 40: 114 (1942).
syn.: *Polysphaerophori* Singer subsect. *Rubroviolascentini* Singer, Beih. Sydowia 2(7): 106 (1973).

Pileus medium-large, firm, fleshy, dry, wrinkled to tomentose, brownish ochre, locally stained blackish. Lamellae distant, thick, large, cream-colour, blackening; edge entire, concolorous. Stipe firm, rather short to medium, velvety, more or less concolorous with pileus, paler at the tomentose base. Context firm, white at first, becoming black then reddish; taste mild. Latex transparent, with greyish pink tinge. Spores very lowly ornamented to almost smooth; plage inamyloid. True pleurocystidia lamprocystidia, abundant and very emergent. Hymenophoral trama mixed. Pileipellis a palisade to trichopalisade; terminal elements with slightly thickened wall, irregularly tortuose. Stipitipellis with thick-walled elements; elements at the base of stipe with globose and swollen apex.

Type: *Lactarius rubroviolascens* R. Heim.

discussion

Heim (1938) described *Lactarius rubroviolascens* from Madagascar and mentioned that the species shows a certain resemblance with *Russula adusta*, but is clearly a *Lactarius* because of its greyish pinkish latex. He also observed a superficial resemblance with *Lactarius volemus* by its habit; the tomentose pileipellis puts the species close to the *Velutini*-group. Heim stated that this milkcap has all characters from a *Russula* in the group *Compactae*: the robustness, dimensions, compactness and pigmentation (ochraceous brown with blackish spots) of the pileus; the solid and firm stipe; the very distant, thick and broad, brittle, cream-colour lamellae, which become black, then blue-violet and have two series of lamellulae; the firm context, becoming black, then red in the pileus; the spores ornamented with fine warts. The species differs from this group of *Russulae* by its abundant, waxy, mild latex which is almost translucid with a greyish pinkish tinge. Seen this link, Heim considered the section *Compactae* as a mixed "lactario-russulé" group. By proposing the name *Compacti* for this group of *Lactarii*, *L. rubroviolascens* being part of it, he stressed the connection between both genera. He reminded also that *Compactae* and *Compacti* together form a group which is not less homogeneous than certain sections in *Russula* or in *Lactarius*.

Singer (1973) described the section *Polysphaerophori* for tropical *Lactarius* species, characterized by a dry, azonate, glabrous to subvelutinate pileus, a hymenophoral trama composed of sphaerocytes and a pileipellis with more or less thick-walled, anticline elements arising from a layer of sphaerocytes (thus a palisade or lampropalisade). In this section he distinguished initially two subsections: the neotropical *Polysphaerophorini* with white and opaque latex and the *Rubroviolascentini* from Madagascar with pale reddish grey, translucent latex. Later (Singer et al., 1983) he adds another subsection, the *Brasilienses* (invalid), for species which have also grey or blackish zones (like in *Rubroviolascentini*) but an unchanging context and white latex. Apparently, he retraced on his steps and did not validate this subsection in his latest classification (1986) and included *L. brasiliensis* Singer in the subsect. *Polysphaerophorini*.

Pegler & Fiard (1979) described *Lactarius nebulosus* Pegler as closely related to *L. rubroviolascens* without confining it to the *Rubroviolascentini*. Nevertheless Singer (1986) classified this species in the *Rubroviolascentini* which I do not agree with because of the lack of the typical thick-walled emergent lamprocystidia. Besides, the latex is just watery without any shade of pink, red, grey or black. The spore-ornamentation in *Lactarius* is much ore prominent than in the African species (up to 1.5 μm high according to Pegler & Fiard, 1979).

Lalli and Pacioni (1992) studied the type-material of *Lactarius rubroviolascens* and excluded it from the section *Lactifluus* on the basis of the unchanging context and the structure of the pileipellis. However, I observed a palisade and not a trichoderm as drawn by Lalli & Pacioni and I want to stress the fact that colour-changes of the context do occur in this species. As a result, I consider the *Rubroviolascentini* as closely related to the section *Lactifluus*. Some particular characters, such as the blackening context, the irregularly tortuose, only slightly thick-walled elements, the globose and swollen apex of the elements at the base of the stipe and the extremely lowly ornamented spores argue for raising the subsection *Rubroviolascentini* Singer to the level of section.

Lactarius rubroviolascens has similar colour-changes as *L. denigricans* Verbeken & Karhula, which is here classified in the section *Pseudogymnocarpi*, a section which shares the emergent and abundant lampropleurocystidia with the section *Rubroviolascentes*.

4. Checklist of African representatives of the subgenus *Lactifluus*

(Remark: extended descriptions besides the original description are cited under "Select. descr." Countries where the species has been collected are listed alphabetically under "Distribution"; for each country, herbaria where material of the species is stored, are listed.)

angustus R. Heim & Gooss.-Font. ap. Heim, Bull. Jard. Bot. Etat 25: 67 (1955).
Holotypus: *Goossens-Fontana* 713 (BR).
Type locality: Zaire, Binga, N 02°28 E 20°31.
Icon.: Heim (1955a: pl. 15, fig. 7; 1955b: pl. 3, fig. 3ab).
Distribution: only known from type locality.

arsenei R. Heim, Candollea 7: 380 (1938, as "arseni").
Holotypus: *Heim* s.n. (PC).
Type locality: Madagascar, W of Ivoloina, road to Ambatondrazaka, W of Tamatave, ± S 15°34 E 49°38.
Select. descr.: Heim (1938b: 61).
Distribution: only known from type locality.

brunnescens Verbeken, Bull. Jard. Bot. Belg. 65: 199 (1996).
Holotypus: *Verbeken* 94.159 (BR, isotypus GENT).
Type locality: Burundi, Nkayamba hill, S 03°58 E 29°26.
Distribution: Burundi (BR, GENT, herb. Buyck), Malawi (herb. Buyck), Zambia (K, herb. Buyck).

caperatus R. Heim & Gooss.-Font. ap. Heim, Bull. Jard. Bot. Etat 25: 36 (1955).
Isotypi: *Goossens-Fontana* 4038 & 4078 (BR: lost, except for the water colours).
Type locality: Zaire, Binga, N 02°28 E 20°31.
Icon.: Heim (1955a: pl. 14, fig. 5ab; 1955b: pl. 3, fig. 1a-c).
Distribution: only known from type locality.

denigricans Verbeken & Karhula ap. Verbeken, Persoonia 16: 219 (1996).
Holotypus: *Saarimäki* et al. 1467 (H).
Type locality: Tanzania, Lirondo.
Icon.: Karhula et al. (1997).
Distribution: only known from type locality.

flammans Verbeken, Mycotaxon 55: 539 (1995).
Holotypus: *Buyck* 3492 (BR, isotypus hb. Buyck).
Type locality: Zambia, near Kitwe, Mwekera-Forest, S 12°52 E 28°16.
Distribution: Zambia (BR, herb. Buyck).

goossensiae Beeli, Bull. Soc. Roy. Bot. Belgique 60: 165 (1928).
Lectotypus: *Goossens-Fontana* 268 (BR).
Type locality: Zaire, Eala, N 00°03 E 18°19.
Select. descr.: Verbeken (1996a: 60).
Distribution: only known from type locality.

gymnocarpoides Verbeken, Mycotaxon 55: 530 (1995).
Misappl.: *Lactarius phlebophyllus* ss. Morris (1990).
Holotypus: *Verbeken* 94.149 (BR, isotypus GENT).
Type locality: Burundi, Rumonge, Nkyamba, S 03°58 E 29°26.

Distribution: Benin (BR), Burundi (BR, GENT, herb. Buyck), Guinea (herb. Thoen), Malawi (K), Senegal (herb. Thoen), Tanzania (H), Zaire (BR), Zambia (K, herb. Buyck), Zimbabwe (K).

gymnocarpus R. Heim ex Singer, Pap. Michigan Acad. Sci. 32: 107 (1946).
Basionym: *Lactarius gymnocarpus* R. Heim, Boissiera 7: 273 (1943), nom. prov.
Syn.: *Lactarius gymnocarpus* R. Heim ex R. Heim, Bull. Jard. Bot. Etat 25: 24 (1955); *Lactarius goossensiae* Beeli p.p., Bull. Soc. Roy. Bot. Belgique 60: 165 (1928).
Excl.: *Lactarius gymnocarpus* ss. Pegler (1977), = *L. pseudogymnocarpus*.
Lectotypus: *Harley* 56 (FH).
Type locality: Liberia, near Nengbe, N 07°12 W 09°01.
Select. descr.: Verbeken (1995a: 520).
Icon.: Heim (1955b: pl. 2, fig. 1b), Thoen & Ba (1989: pl. 1, fig. 2e).
Distribution: Cameroon (E, PC), Guinea (PC, herb. Thoen), Ivory Coast (PC), Liberia (FH), Senegal (BR, herb. Thoen), Zaire (BR, GENT).

kivuensis Verbeken, Bull. Jard. Bot. Belg. 65: 202 (1996).
Holotypus: *Rammeloo* Z 310 (GENT).
Type locality: Zaire, Kivu, Irangi, S 01°53 E 28°27.
Distribution: only known from type locality (GENT).

longisporus Verbeken, Mycotaxon 55: 527 (1995).
Misappl.: *Lactarius gymnocarpus* ss. Buyck & Nzigidahera (1996).
Holotypus: *Verbeken* 94.557 (BR, isotypus GENT).
Type locality: Burundi, Rumonge Forest Reserve, Nyamirambo hill, S 04°07 E 29°37.
Distribution: Burundi (BR, GENT, herb. Buyck), Kenya (BR), Zaire (BR), Zambia (herb. Buyck), Zimbabwe (BR).

luteopus Verbeken, Mycotaxon 55: 536 (1995).
Misappl.: *Lactarius* cfr. *caperatus* ss. Morris (1990).
Holotypus: *Verbeken* 94.463 (BR, isotypus GENT).
Type locality: Burundi, Rumonge Forest Reserve, Nyamirambo hill, S 04°07 E 29°37.
Icon.: Karhula et al. (1997).
Distribution: Burundi (BR, GENT, herb. Buyck), Malawi (K, herb. Buyck), Tanzania (H, K), Zambia (K, herb. Buyck).

medusae Verbeken, Mycotaxon 55: 532 (1995).
Misappl.: *Lactarius vellereus* ss. Morris (1984, 1987, 1990), Williamson (1975, 1976); *L. latifolius* ss. Parent & Thoen (1977); *L. gymnocarpus* ss. Pegler & Piearce (1980).
Holotypus: *Buyck* 3455 (BR, isotypus herb. Buyck).
Type locality: Zambia, near Kawambwa, S 09°48 E 29°06.
Select. descr. et icon.: Karhula et al. (1997).
Distribution: Malawi (K), Tanzania (H), Zaire (herb. Thoen), Zambia (BR, K, herb. Buyck).

nonpiscis Verbeken, Bull. Jard. Bot. Belg. 65: 204 (1996).
Holotypus: *Buyck* 3171 (BR, isotypus herb. Buyck).
Type locality: Zambia, Chati-forest, near Kitwe, S 12°49 E 28°12.
Distribution: Zambia (BR, herb. Buyck).

phlebonemus R. Heim & Gooss.-Font. ap. Heim, Bull. Jard. Bot. Etat 25: 38 (1955).
Syn.: *Lactarius phlebonemus* f. *brunneus* α R. Heim, ibid.: 39; f. *brunneus* β R. Heim, ibid.: 40; *f. ocraceus* R. Heim, ibid.: 43 (infraspecific forms without taxonomic significance).
Holotypus: *Goossens-Fontana* 956 (BR).
Type locality: Zaire, Binga, N 02°28 E 20°31.
Icon.: Heim (1955a: pl. 14, fig. 2-4; 1955b: pl. 3, fig. 2ab & pl. 4, fig. 1ab, 2).

Distribution: Cameroon (E), Zaire (BR).

pisciodorus R. Heim, Candollea 7: 380 (1938).
Holotypus: *Heim* J52 (PC).
Type locality: Madagascar, Nosy-Mangabe (Ile Marosse), S 15°30 E 49°46.
Select. descr.: Heim (1938b: 58).
Icon.: Heim (1938b: pl. 1e).
Distribution: only known from type locality.

pseudogymnocarpus Verbeken, Mycotaxon 55: 523 (1995).
Misappl.: *Lactarius gymnocarpus* ss. Pegler (1977).
Holotypus: *Goossens-Fontana* 899 (BR).
Type locality: Zaire, Binga, N 02°28 E 20°31.
Select. descr.: Pegler (1977: 571, as "*L. gymnocarpus*").
Icon.: Heim (1955a: pl. 13, fig. 1a,c & 1955b: pl. 2, fig. 1a,c-e).
Distribution: Tanzania (K), Zaire (BR).

pseudovolemus R. Heim, Candollea 7: 378 (1938).
Holotypus: *Heim* G61 (PC).
Type locality: Madagascar, S of Maningory, ± S 17°10 E 49°28.
Select. descr.: Heim (1938b: 49).
Distribution: only known from type locality.

pumilus Verbeken, Bull. Jard. Bot. Belg. 65: 205 (1996).
Holotypus: *Verbeken* 94.599 (BR, isotypus GENT).
Type locality: Burundi, Rumonge Forest Reserve, Nyamirambo hill, S 04°07 E 29°37.
Icon.: Karhula et al. (1997).
Distribution: Burundi (BR, GENT, herb. Buyck), Senegal (BR), Tanzania (H), Zambia (K).

rubiginosus Verbeken, Bull. Jard. Bot. Belg. 65: 207 (1996).
Holotypus: *Buyck* 3466 (BR).
Type locality: Zambia, Chati-forest, near Kitwe, S 12°49 E 28°12.
Distribution: Tanzania (H, WAG), Zambia (BR, K, herb. Buyck).

rubroviolascens R. Heim, Candollea 7: 377 (1938).
Holotypus: *Heim* G85 (PC).
Type locality: Madagascar, S of Soanierana, near Manompana, ± S 16°55 E 49°35.
Select. descr.: Heim (1938b: 46).
Icon.: Heim (1938b: pl. 1c).
Distribution: Cameroon (E), Madagascar (PC), Zaire (herb. Thoen).

tanzanicus Karhula & Verbeken ap. Karhula et al., Karstenia 37.
Holotypus: *Saarimäki* et al. 1277 (H).
Type locality: Tanzania, Kilwa distr., Mavuji, S 08°58 E 39°24.
Icon.: Karhula et al. (1997).
Distribution: Tanzania (H, WAG).

volemoides Karhula ap. Karhula et al., Karstenia 37.
Holotypus: *Saarimäki* et al. 705 (H).
Type locality: Tanzania, Mbeya distr., Mbozi, S 09°02 E 32°56.
Icon.: Härkönen et al. (1995: fig. 72, as *L.* aff. *pseudovolemus*).
Distribution: Tanzania (H).

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STUDIES IN TROPICAL AFRICAN *LACTARIUS* SPECIES. 6. A SYNOPSIS OF THE SUBGENUS *LACTARIOPSIS* (HENN.) R. HEIM EMEND.

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Abstract

An emendation of the subgenus *Lactariopsis* (Henn.) R. Heim is proposed, based on studies from 11 African species. Nine species are classified in the sections *Lactariopsidei* Singer ex Singer and *Chamaeleontini* Verbeken sect. nov.; two species, *Lactarius indusiatus* Verbeken and *L. pruinatus* Verbeken & Buyck sp. nov., are provisionally not classified at section level. The temperate section *Albati* (Bat.) Singer emend. Hesler & A.H. Sm. (group of *Lactarius vellereus*) is also included in this subgenus. A key to the species of each section is given, as well as a check-list of the African species in this subgenus.

The relationships of the *Chamaeleontini* with *Russula* subsect. *Amoeninae* Singer ex Buyck, and *Lactariopsis* with the genus *Pleurogala*, are discussed.

ADDITIONAL KEYWORDS: *Albati, Russula, Pleurogala,* infrageneric classification.

1. INTRODUCTION

This paper is the sixth reporting on an extended study of tropical African *Lactarius* species. As already stated before (previous paper), existing infrageneric classifications, largely based on European and North American taxa, showed to be unobliging for the African species. A new classification for the "annulate" tropical species and related taxa is proposed here.

2. A NEW DEFINITION OF THE SUBGENUS *LACTARIOPSIS*

Lactarius subgenus *Lactariopsis* (Henn.) R. Heim, Prodr. Fl. Mycol. Madagascar: 36 (1938), emend.

Pileus firm and fleshy to thin and fragile; pellis smooth and often shiny, when thick and velvety or pruinose then rupturing near the margin and showing a more smooth and shiny layer, yellowish, with orange and pale brownish tinges, often striate or even sulcate near the margin. Secondary velum absent or present and then forming an annulus. Spores subglobose to ellipsoid; ornamentation low, up to 1 μm high, composed of irregularly shaped and sized warts, sometimes connected by some fine connective lines, sometimes forming an incomplete to complete reticulum; plage usually inamyloid. True pleurocystidia usually absent; if present then non-emergent, cylindrical to subclavate, moniliform to rostrate and thin-walled; never emergent and thick-walled. Pseudopleurocystidia mostly abundant, fusiform to cylindrical and emergent to very emergent. Hymenophoral trama composed of sphaerocytes and numerous lactifers. Pileipellis a lamprotrichopalisade to lampropalisade or mixed trichopalisade or a lamprotrichoderm; thick-walled and hair-shaped elements abundant, scattered or seldom absent.

Type: *Lactarius zenkeri* (Henn.) Singer.

discussion

Hennings (1902) created the genus *Lactariopsis* characterized by an involute margin connected with the stipe by a membranaceous velum, in which he described one species, *L. zenkeri*, from Cameroon. He mentioned that the other characters of this mushroom are not at variance with the genus *Lactarius*. Heim (1937) maintained this new genus, when he first described "*Lactariopsis pandani*" (= *Lactarius annulatoangustifolius*), characterized by a "lignicolous habit" (whereas Hennings stated "on rotten wood or terrestrial") and a thick "velum" with radial, gelatinized and subtranslucid veins in young specimens, becoming whitish and membranaceous when older. After a detailed study of young basidiomes, he proposed the term "pseudoangiocarpic development" after the example of Kühner (1925) for the encountered type of development, consisting of three phases:

(1) an initial phase with gymnocarpic development; the hymenial cavity is not entirely closed, there is a connection with the environment;

(2) phase of soldering (centripetal); the hymenial cavity is then closed, the lamellae develop, the basidia produce spores and the sporulation starts;

(3) phase of rupturing (centrifugal).

Later Heim (1938b) considered *Lactariopsis* as a subgenus in the genus *Lactarius*; he stated that one cannot define a genus on the basis of that pseudangiocarpic development. Singer (1942) shared this point of view and created the section *Lactariopsidei*.

Gilbert (1947) introduced the term "velum marginale" for the velum formed by the secondary proliferation of hyphae at the margin of the pileus in a pseudangiocarpic development. The annuliform organ thus formed is called a "marginella", which is indeed proposed for tropical *Russulae* and certain boletes.

Reijnders (1963) proposed the term secondary angiocarpic development instead of pseudangiocarpic development, as primary (or true) angiocarpic development and secondary angiocarpic development often occur together, and thus the terminology of Kühner becomes rather contradictory. The secondary velum, according to Reijnders (1963), is a part of the primordium which grows out in a later phase, while the primary velum is formed at the same time as the primordium. In the secondary angiocarpic development, he distinguishes three types: pilangiocarpic development when the margin of the pileus proliferates and adheres to the stipe; mixangiocarpic development when there are also hyphae growing out of the stipe surface so that the annulus is connected with the stipe; stipitangiocarpic development when the hyphae only proliferate out of the stipe. The development of "*Lactarius pandani*" is described as mixangiocarpic, then pilangiocarpic, thus leaving an annulus and flocks at the margin of the pileus as remnants of a secondary velum.

As a result, the creation of a subgenus based on the presence of secondary velum seems artificial to me. Therefore, I propose a larger definiton of the subgenus, allowing to include species which show very close affinities with "annulate" species but which do not have such a secondary angiocarpic development.

Following sections are included: *Lactariopsidei*, *Chamaeleontini* and *Albati* s.str. Two species, *Lactarius indusiatus* Verbeken and *L. pruinatus* Verbeken & Buyck nov. sp., answer the description of the subgenus, but are, due to some minor aberrant characters, provisionally not classified in a section. It seems premature to raise a separate section for each of those two species, therefore they are keyed out here between the three accepted sections in the subgenus.

key to the sections and additional species:

1. Suprapellis of the pilei- and stipitipellis entirely composed of thick-walled and hair-shaped elements 2

Hair-shaped, thick-walled elements in the suprapellis of the pileipellis scattered or absent 4

2. Secondary velum present and distinct in old and young basidiomes, forming a clear annulus . . . . sect. **Lactariopsidei**

Secondary velum absent; pileipellis at most velvety and pruinose; annulus never present 3

3. Pseudocystidia broad and emergent; true cystidia absent . . **L. pruinatus**

Pseudocystidia not emergent; macrocystidia present .... sect. **Albati**

4. Secondary velum present in young basidiomes as an arachnoid indusium between the stipe and the margin of the pileus, sometimes remaining as a very small annulus in older basidiomes; thick-walled hair-shaped elements in the suprapellis of the pileipellis scarce, most elements clavate to subclavate and thin-walled; context changing pinkish or reddish, then greyish green .... **L. indusiatus**

Secondary velum absent, even in young basidiomes; thick-walled hair-shaped elements in the pileipellis absent or scattered; context unchanging .... sect. **Chamaeleontini**

2.1. section Albati

The section *Albati* (Bat.) Singer s. str. was excluded from the subgenus *Lactifluus* (Verbeken, previous paper) because of the different pileipellis-structure, more particular: the lack of a pseudoparenchymatous layer.

The pileipellis-structure in *Lactarius vellereus* (Fr.: Fr.) Fr. and allied species, which is a lamprotrichoderm (Verbeken & Vesterholt, 1997), and the spore-ornamentation argue for a classification in this subgenus. The presence of macropleurocystidia and the absence of broad and emergent pseudocystidia distinguish this group from the other sections. In this context it is interesting to note that Hesler & Smith (1979) already suggested that the North American species *Lactarius deceptivus* (sect. *Albati* stirps *deceptivus*) represents the closest relative of the tropical annulate species, because it rarely shows an evanescent zone of velum near the stipe. In those cases the margin is enroled and connected with a soft, cottony excrescence towards the apex of the stipe, thus simulating a partial velum.

Lactarius vellereus (Fr.: Fr.) Fr. (section *Albati*) has been cited several times from Malawi (Morris 1984-1990, Williamson 1975-1976) but this is based on misidentifications of *L. medusae* Verbeken. As no tropical African representatives are known, the section is not treated here.

2.2. Section *Lactariopsidei*

Lactarius sect. *Lactariopsidei* Singer ex Singer, Sydowia 15: 83 (1962).
Syn.: *Lactariopsis* Henn., Bot. Jahrb. Syst. 30: 51 (1902); *Lactarius* sect. *Lactariopsidei* Singer, Pap. Michigan Acad. Sci. 32: 105 (1946, descr. gall.).

Pileus firm and fleshy to thin and fragile; pellis submembranaceous, pruinose or thick and velvety, rupturing near the margin and showing a smooth and usually darker layer, often striate near the margin. Secondary velum present, covering the hymenium in young basidiocarps, leaving a membranaceous, non-mobile, thin and whitish annulus near the apex of the stipe in mature specimens. Lamellae adnate to decurrent, waxy to brittle, yellowish white to ochraceous; edge entire, concolorous. Stipe cylindrical, firm, solid. Context firm, white to cream-colour, unchanging, fibrillose in the stipe; taste mostly acrid to very acrid. Latex rather scarce, white; taste mild or acrid. Spores mostly ellipsoid; ornamentation amyloid, composed of irregularly shaped and sized warts and ridges, sometimes connected by fine connective lines, sometimes forming an incomplete to subcomplete reticulum; plage mostly inamyloid. True pleruocystidia absent. Pseudopleurocystidia 10-25 μm diam., clavate or fusiform, mucronate, very emergent, with needle-like or granular content. Hymenophoral trama composed of sphaerocytes and numerous lactifers. Pileipellis and stipitipellis a lamprotrichopalisade to lampropalisade; elements of the suprapellis very thick-walled, long, slender, hair-shaped and tapering upwards, septate and sometimes branched. Distribution tropical Africa and neotropics.

Type: *Lactarius zenkeri* (Henn.) Singer.

discussion

When describing *Lactarius gymnocarpus*, Heim (1943) added this species to his subgenus *Lactariopsis* because of the same colour and the same veined aspect of the pileus with veins prolonging on the stipe, similar rigid, thick-walled "hairs" of the pileipellis and stipitipellis, similar pleurocystidia and similar ornamentation-type of the spores. In the mean time, Singer (1946) received some Liberian collections and provided detailed descriptions of *Lactarius zenkeri* (i.c. a misapplication of *L. annulatoangustifolius*) and *L. gymnocarpus*. Both Heim and Singer emended the section as follows: presence of persistent hairy or membranaceous velum, presence of pleurocystidia, ovoid-ellipsoid spores with reticulate-verrucose ornamentation and lignicolous habit. The section included then *Lactarius zenkeri*, *L. pandani* and *L. gymnocarpus*.

I exclude *Lactarius gymnocarpus* from the section because of the lack of a pseudangiocarpic development, secondary velum on pileus and stipe (annulus). Furthermore, the pseudocystidia are not as remarkably broad and emergent, and the structure of the pileipellis is a real lampropalisade with a distinctly developed subpellis. It therefore fits much better in the subgenus *Lactifluus*, section *Gymnocarpi* R. Heim ex Verbeken.

Heim (1955) finally placed *Lactariopsis* as group in his section *Caperati*, together with the group *Gymnocarpi* and the group *Phlebonemi*, now placed in the subgenus *Lactifluus*.

Singer (1952; Singer et al., 1983) added two new, neotropical species in the section *Lactariopsidei* Singer: *Lactarius annulifer* and *L. neotropicus*. Both species are provisionally accepted in the section by the present author (material not studied).

Redhead & Norvell (1993) considered the velate and "lignicolous" habit as arguments to maintain *Lactariopsis* Henn. as a separate genus, to "make *Lactarius* more homogeneous". The present author cannot agree with this. The (pseudo)lignicolous habit is not a constant character in the *Lactariopsidei*, and many more unveiled *Lactarius* species grow often on rotten wood in the African rainforests. Moreover, the recently described "*Lactariopsis*" species from woodland vegetation, *Lactarius velutissimus* and *L. heimii*, always grow terrestrial. In this context, the presence of an annulus cannot be considered as an argument to maintain a separate genus. In tropical Russula species an annulus is present in species belonging to different sections (*Crassotunicatae, Ingratae, Fistulosae*; Buyck, pers. comm.). Finally, the microscopic characters of those annulate *Lactarius* species, are very similar to those of other groups of *Lactarius*.

key to the tropical African species

1. Ornamentation of the spores up to 1 μm high . . **L. annulatoangustifolius**

Ornamentation of the spores up to 0.2 μm high 2

2. Spores ellipsoid to elongate, Q = (1.16)1.30-1.50(1.65), spores up to 11.5 μm long; spore-ornamentation an almost complete reticulum . . **L. heimii**

Spores ellipsoid, sometimes subglobose, Q = (1.09)1.19-1.32(1.45), spores usually shorter than 9(10) μm; spore-ornamentation an incomplete reticulum, always with distinct warts 3

3. Pileipellis remarkably thick, felty, yellowish white, persistent, with stellately rupturing; spores 8.4-9.2 μm long . . . . **L. velutissimus**

Pileipellis thinner, submembranaceous 4

4. Basidiomes fragile, yellowish brown to pale ochraceous; spores small, 7.1-7.8 × 5.5-6.3 μm, with extremely low ornamentation; marginal cells tortuous and branched . . . . **L. zenkeri**

Basidiomes firmer, pale yellow ochre to pale yellowish; spores larger, 8.0-8.6 × 6.4-7.0 μm, ornamentation 0.2 μm high; marginal cells narrowly utriform to conical . . . . **L. pelliculatus**

remark

This section is well represented both in African rainforests as well as in woodland vegetation types. It concerns a complex group of species which need further study. Especially the lack of descriptions on fresh basidiocarps made it impossible to identify a fairly large number of exsiccata.

2.3. Section *Chamaeleontini*

Lactarius sect. *Chamaeleontini* sect. nov.

Pileus 1-10 cm diam., convexus, tum depressus ad infundibuliformis, margine valde striato ad sulcato; pileipellis laevis, non viscosa, leviter fibrosa in centro, pallide aurantia ad ochracea. Stipes (2.5)4-10 cm longus, 0.3-2.5 cm crassus, pallide aurantiacus. Lamellae adnatae ad decurrentes, moderate distantes ad distantes, latae; pallide flavae. Sporae subglobosae ad ellipsoideae, verrucis sublaevibus, interdum connexis vel in cristis brevibus confluentibus ornatae; macula suprahilaris interdum diffuse centrale amyloidea. Pleurocystidia vera absentia. Pseudopleurocystidia emergentia, cylindrata ad fusiformia. Pileipellis mixta; elementa trichoidea pariete incrassato presentia. Trama lamellae heteromera.

Typus: *Lactarius chamaeleontinus* R. Heim.

Pileus 1-10 (or more) cm diam., convex, then depressed to infundibuliform; margin strongly striate to deeply sulcate; pellis smooth, shiny, especially shiny in exsiccata, finely fibrous in the centre, pale orange, ochraceous. Stipe (2.5)4-10 × 0.3-2.5 cm, pale orange. Lamellae adnate to decurrent, unequal with one lamellula between two lamellae, fairly distant to distant, broad, pale yellowish. Spores subglobose to ellipsoid, ornamentation composed of warts and ridges, never forming a complete reticulum; plage with a faintly amyloid spot in the centre. True pleurocystidia absent. Pseudopleurocystidia emergent, 8-16 μm diam., cylindrical or fusiform. Hymenophoral trama composed of sphaerocytes. Pileipellis a trichoderm or a trichopalisade, usually mixed with hair-shaped, thick-walled elements, those often arising in the trama under the pellis.

Type: *Lactarius chamaeleontinus* R. Heim.

discussion

Heim (1955a) included *Lactarius chamaeleontinus* in the section *Pelliculares* R. Heim together with *L. pellicularis*. *Lactarius pellicularis*, now considered as synonymous with *L. russulaeformis*, Verbeken, 1996a), has totally different microscopic characters and does not belong to the subgenus *Lactariopsis*: the ornamentation of the spores consists of long, acute spines connected by fine connective lines; the hymenophoral trama is composed of hyaline hyphae and lacks sphaerocytes; the pseudocystidia are not emergent and fusiform; the pileipellis-structure is a hymeniderm.

Very similar scattered thick-walled hair-shaped elements in the pileipellis are also observed in the genus *Pleurogala* (syn.: *Lactarius* sect. *Panuoidei* Singer) which is discussed in a following paragraph.

The section *Chamaeleontini* seems related with the subsection *Amoeninae* Singer ex Buyck of the genus *Russula* (section *Crassotunicatae*: see Buyck, 1994). The *Russula* species in this subsection are versicolorous, but some of them have the yellow to brownish tinges which occur in the *Lactarii* of the section *Chamaeleontini*. The pileus is in both tropical groups longly striate, rather fragile and with a thin margin. The structure of the pileipellis in the section *Chamaeleontini* is very particular: mainly chains of subglobose cells mixed with scarce thick-walled and acute hairs. This is comparable with the pileipellis-structure depicted by Buyck (1994) for *Russula fimbriata* Buyck. Thick-walled elements in the pileipellis are common in the *Amoeninae*, but just as in section *Chamaeleontini*, they occur scattered in the pellis. Other indications for a relationship between these groups are the presence of annulate species in subsection *Amoeninae* and the observation of pseudocystidia-like elements in *Russula incrassata* (Buyck, 1989b: fig. 301 and 302; 1994).

key to the species

1. Pileipellis a trichoderm without hair-shaped, thick-walled elements; pseudopleurocystidia rather abundant . . . . **L. laevigatus**

   Pileipellis a trichoderm mixed with abundant hair-shaped, thick-walled elements; pseudopleurocystidia rather scarce 2

2. Pileus 5-10 cm diam., thick and fleshy; spores 8.2-8.6 × 6.7-7.2 µm, ornamentation not exceeding 0.2 µm height; latex unchanging . . . . **L. sesemotani**

   Pileus up to 5 cm diam., thin and fragile; spores 9-10 × 7.7-8.3 µm, ornamentation up to 0.5 µm high; latex changing ochraceous . . . . **L. chamaeleontinus**

2.4. *Lactarius indusiatus*

Lactarius indusiatus Verbeken, Bull. Jard. Bot. Belg. 65: 201 (1996) — Fig. 1-3.

Pileus 3-6.5 cm diam., rather thick, firm, convex to applanate, then infundibuliform; margin involute when young, then straight, sometimes slightly crenulate; pellis not or hardly dehiscent, smooth, soon dessicating, greyish orange to pale orange or leather-brown in the centre (6E45) and greyish yellow (4B34) near the margin. *Stipe* 2.4-4.3 × 0.7-1.9 cm, cylindrical, rather short and broad, slightly tapering downwards, smooth, greyish orange to pale orange, brownish orange (5C3) near the base, yellowish grey (4B2) in the upper part or paler towards the base and the apex, firm, solid. *Lamellae* slightly decurrent, unequal with lamellulae of different lengths (1-3 lamellulae between two lamellae), rather distant (4+2/cm), moderately broad (2-4 mm), thick, firm, tough, without venation, very seldom dichotomously branched, orange-yellow, pale orange to light orange (5A34); edge entire, slightly darker. *Context* firm, white, changing salmon pink or dull red (8C3), greyish green when cut or bruised, not changing with $FeSO_4$; smell agreeable, sweet; taste acrid, burning. *Latex* scarce, white; taste acrid. *Velum* present in young specimens as an arachnoid indusium between the stipe and the margin of the pileus; sometimes remaining as a small annulus in the older specimens. *Spore-deposit* not observed.

Spores subglobose to ellipsoid, 6.9-*7.8*-*8.2*-9.1 × 5.5-*6.3*-*7.0*-8.0(8.1) µm (Q = 1.09-1.16-1.22- 1.38, n = 40); almost smooth; ornamentation very faint, composed of some very small warts and ridges; plage inamyloid. *Basidia* (50)60-80 × 8-9(10) µm, cylindrical, long, slender, 4-spored, sometimes 2-spored. *True pleurocystidia* leptocystidia, rather abundant, 65-80 × 8-10 µm, cylindrical to subclavate, moniliform to rostrate, thin-walled to slightly thick-walled; content guttate. *Pseudopleurocystidia* abundant, 6-9 µm, cylindrical to subfusiform, tapering upwards, often emergent; content oleiferic, slightly needle-like. *Lamella-edge* sterile; marginal cells long, slender, cylindrical, with rounded apex, 20-35 × 3-5(6) µm, often septate, thin-walled, hyaline; pseudocystidia present. *Hymenophoral trama* composed of sphaerocytes and rather abundant lactifers. *Pileipellis* a mixed trichopalisade; terminal elements 10-20(25) × 4-10(12) µm, subclavate to clavate, thin-walled, hyaline; hair-shaped, thick-walled elements scarce, but present. *Stipitipellis* a trichoderm; terminal elements 15- 50(60) × 4-6 µm, long, cylindrical or tapering upwards, thin-walled or slightly thick-walled, hyaline, recumbent or ascending. *Velum* composed of long, narrow, parallel, thin-walled hyphae, 2-4(5) µm diam., septate. *Clamp-connections* absent.

examined material

Burundi, Bururi Prov.— Miombo woodland dominated by *Brachystegia utilis*: Nyamirambo, Rumonge Forest Reserve, 850-950 m alt., iii 1994, *Verbeken* 94.122 (holotypus BR); open miombo woodland dominated by *B. bussei, B. microphylla*: Nkayamba, just N of Rumonge, 850-950 m alt., iii 1992, *Buyck* 4211 et icon. phot.; ibid, under *B. utilis*, *Buyck* 4290 (priv. herb. Buyck).

The macroscopic description is based on fieldnotes of Verbeken. The microscopic description is based on all cited collections.

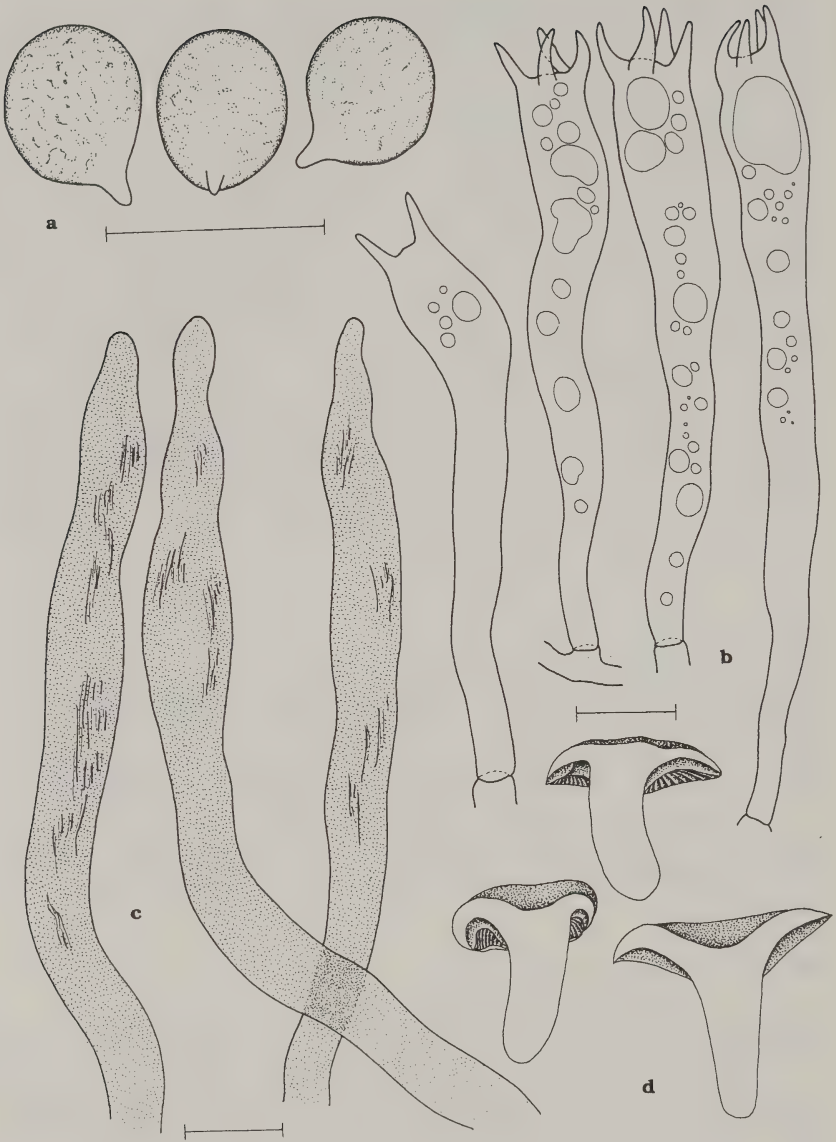

Fig. 1. *Lactarius indusiatus* (holotypus). a. spores, b. basidia, c. pseudopleurocystidia, d. habitus (× 1) (scale bar = 10 μm).

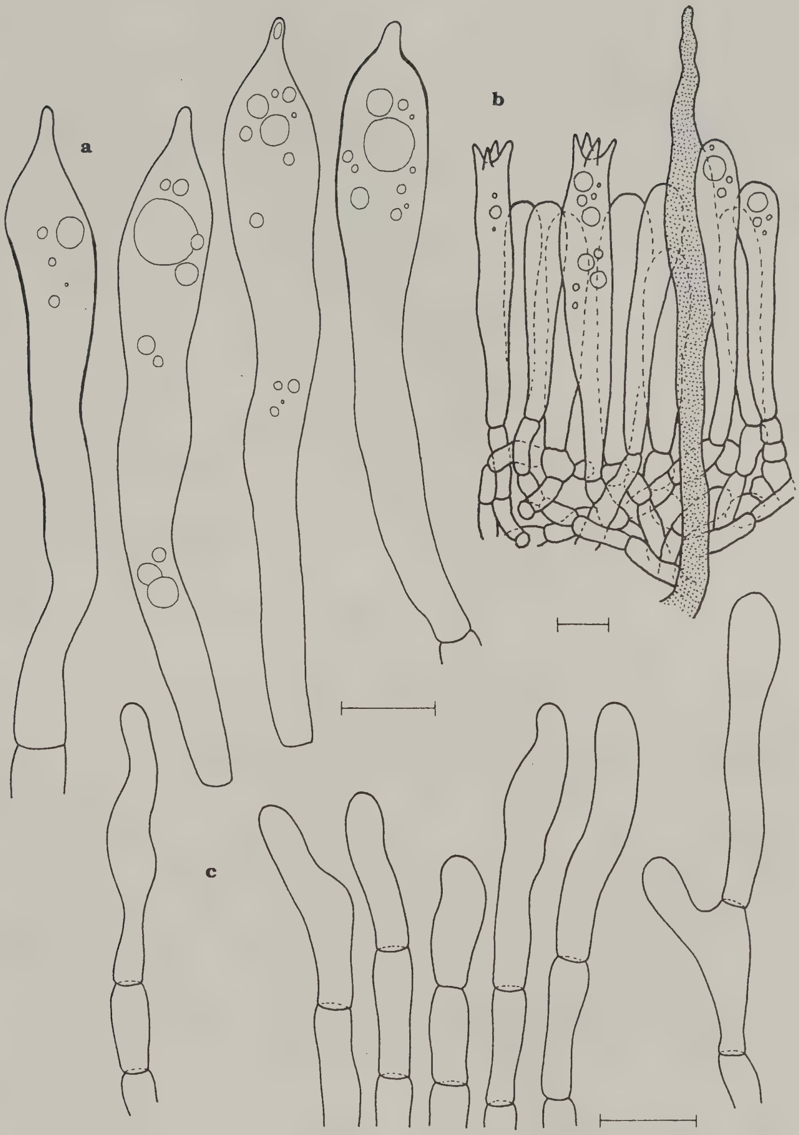

Fig. 2. *Lactarius indusiatus* (holotypus). a. true pleurocystidia, b. hymenium, subhymenium, c. marginal cells (scale bar = 10 μm).

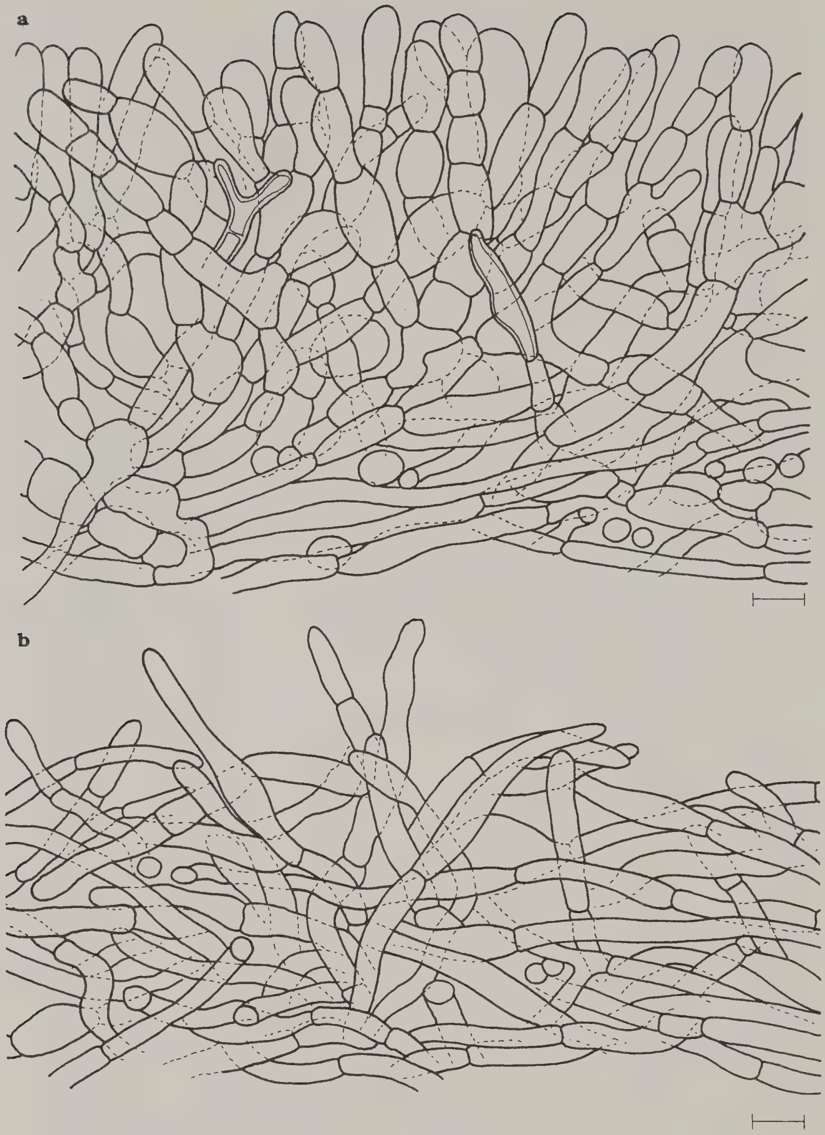

Fig. 3. *Lactarius indusiatus* (holotypus). a. section through the pileipellis, b. section through the stipitipellis (scale bar = 10 µm).

discussion

Lactarius indusiatus is characterized by its extremely lowly ornamented spores (the faintest ornamentation I have ever observed in the genus) and by its velum which is present in young basidiomes as an indusium between the stipe and the incurved margin of the pileus. This velum can even remain as a small and brittle, membranaceous annulus at the apex of the stipe of older specimens. Despite the presence of a velum, *Lactarius indusiatus* cannot be placed in sect. *Lactariopsidei* because of the completely different pileipellis-structure: a "mixed trichoderm" type, which is also found in the sect. *Chamaeleontini*. The species is also closely related to the species of that section, especially to *Lactarius laevigatus*, which in one specimen is also observed to have an indusium. Besides the presence of an indusium, *Lactarius indusiatus* differs especially from th especies in the section *Chamaeleontini* by the changing context, the longer basidia, the extremely lowly ornamented spores, the immediately burning acrid context and the presence of thick-walled hairs in the pileipellis.

2.5. *Lactarius pruinatus*

Lactarius pruinatus Verbeken & Buyck spec. nov. - Fig. 4-6.

Pileus 17-25 mm diam., applanatus et in centro leviter depressus, parvo papillo; pileipellis pruinosa, leviter hirsuta, flavo-brunnea ad pallide brunnea. Stipes 18-25 mm longus, 5-10 mm crassus, complanatus, irregulariter plicatus, albus ad cremeus. Lamellae decurrentes, moderate distantes, cremeae. Contextus albus ad cremeus, gustu acrissimus. Latex albus, gustu acrissimus. Sporae subglobosae ad ellipsoideae, 8.4-*9.8*-11 × 7.4-*8.2*-9.0 μm, regulariter reticulatae; macula suprahilaris non amyloidea. Basidia 55-65 × 12-14 μm, tetraspora, interdum bispora, subclavata. Pleurocystidia vera absentia. Pseudopleurocystidia emergentia usque ad 35 μm, 7-18 μm diam., cylindrata vel fusiformia, interdum mucronata. Pileipellis lamprotrichoderma, elementa suprapellis 20-50(70) × 4-7 μm, pariete incrassato.

Holotypus: **Zambia**, Copperbelt prov. Near Kitwe, Chati-forest, secondary miombo woodland with *Brachystegia spiciformis, Syzygium cordatum* and *Swartzia madagascariensis*, 24 xii 1990, *Buyck* 3248 c. icon. phot. (GENT, isotypus herb. Buyck).

Pileus 17-25 mm diam., almost applanate, slightly depressed in the centre, with central papilla; margin straight, not really striate but radially wrinkled when drying; pellis mat, dry, pruinose, with very short hairs, yellowish brown to pale brown (4AB6 - 5C4-6). *Stipe* 18-25 × 5-10 mm, strongly flattened, with irregular folds and a bit tortuous, fragile and completely hollow; pellis velvety, with short hairs, white to cream-coloured, pure white at the base. *Lamellae* clearly decurrent, moderately distant, with lamellulae, cream-coloured (3A2-3); edge entire, concolorous. *Context* white to cream-coloured, unchanging to pale greyish with FeSO*4*; taste very acrid. *Latex* white, unchanging or a bit watery; taste very acrid. *Spore-deposit* white.

Spores subglobose to ellipsoid, 8.4-*9.8*-11 × 7.4-*8.2*-9.0 µm (n = 20, Q = 1.07-1.19-1.30); ornamentation amyloid, very regularly reticulate, composed of ridges, up to 0.5(1) µm high, forming an almost complete to complete reticulum; wall clearly and typically rugose between the meshes; plage not amyloid. *Basidia* 4-spored, seldom 2-spored, 55-65 × 12-14 µm, subclavate; sterigmata 8-10 × 2-3 µm. *True pleurocystidia* absent. *Pseudopleurocystidia* not very abundant, mostly emergent up to 35 µm, 7-18 µm broad, fusiform, sometimes with moniliform apex, thin-walled or with slightly refringent walls; content slightly needle-like. *Lamella-edge* sterile: marginal cells cylindric or fusiform, 17-40 × 2-7 µm, thin-walled, hyaline. *Hymenophoral trama* composed of sphaerocytes mainly; some hyaline hyphae and lactifers present. *Subhymenium* cellular. *Pileipellis* a lamprotrichoderm; elements of the suprapellis cylindric to subcylindric, with obtuse or more or less acute apex, 20-50(70) × 4-7 µm, thick-walled and sometimes septate; subpellis composed of hyaline hyphae. *Stipitipellis* a lamprotrichoderm; elements of the suprapellis cylindric to subcylindric, with obtuse or more or less acute apex, sometimes branched, 20-80 × 3-10 µm, thick-walled and sometimes septate; subpellis composed of hyaline hyphae. *Clamp-connections* absent.

discussion

The pileipellis-structure of *L. pruinatus*, a clear lamprotrichoderm, resulting in a very pruinose, almost hairy pileus, reminds most the species of the section *Lactariopsidei*. The species is however not included in this section because there is no secondary angiocarpic development. The spore-ornamentation, very similar to this of *L. annulatoangustifolius* (Verbeken, 1996a), the emergent and broad pseudopleurocystidia and the cellular hymenophoral trama all argue for a classification in the subgenus *Lactariopsis*.

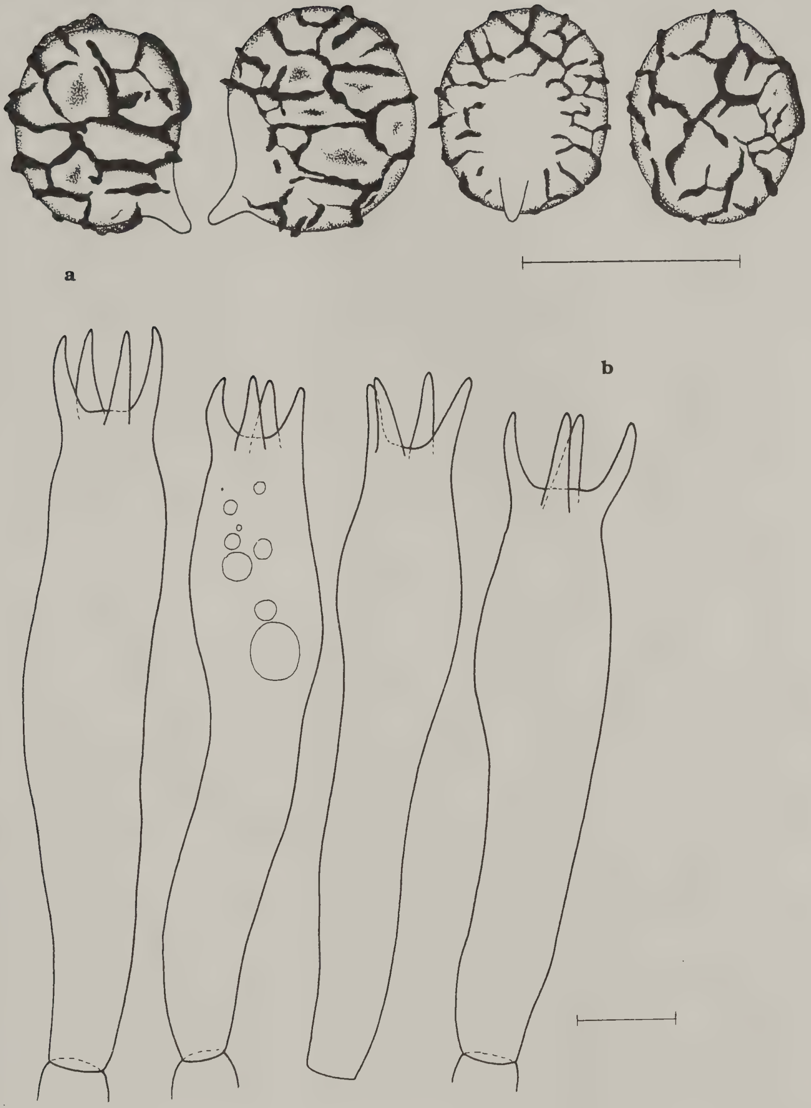

Fig. 4. *Lactarius pruinatus* (holotypus). a. spores, b. basidia (scale bar = 10 µm).

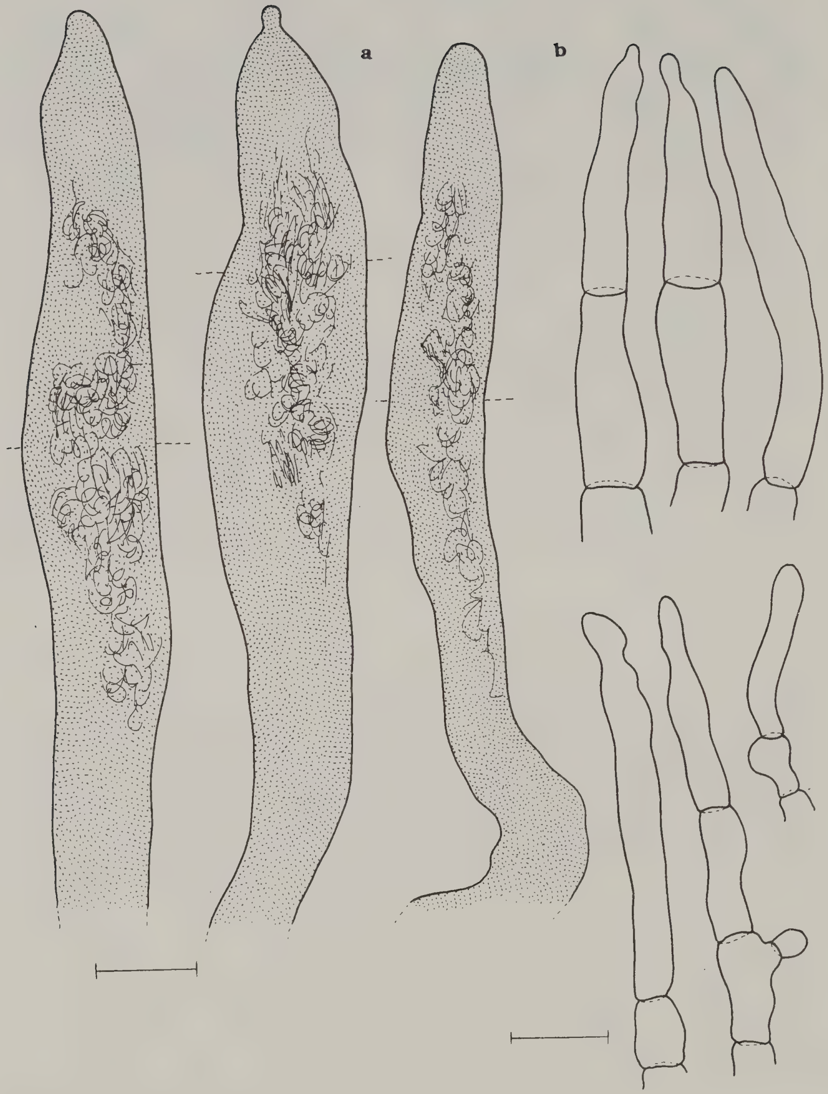

Fig. 5. *Lactarius pruinatus* (holotypus). a. pseudopleurocystidia, b. marginal cells (scale bar = 10 µm)

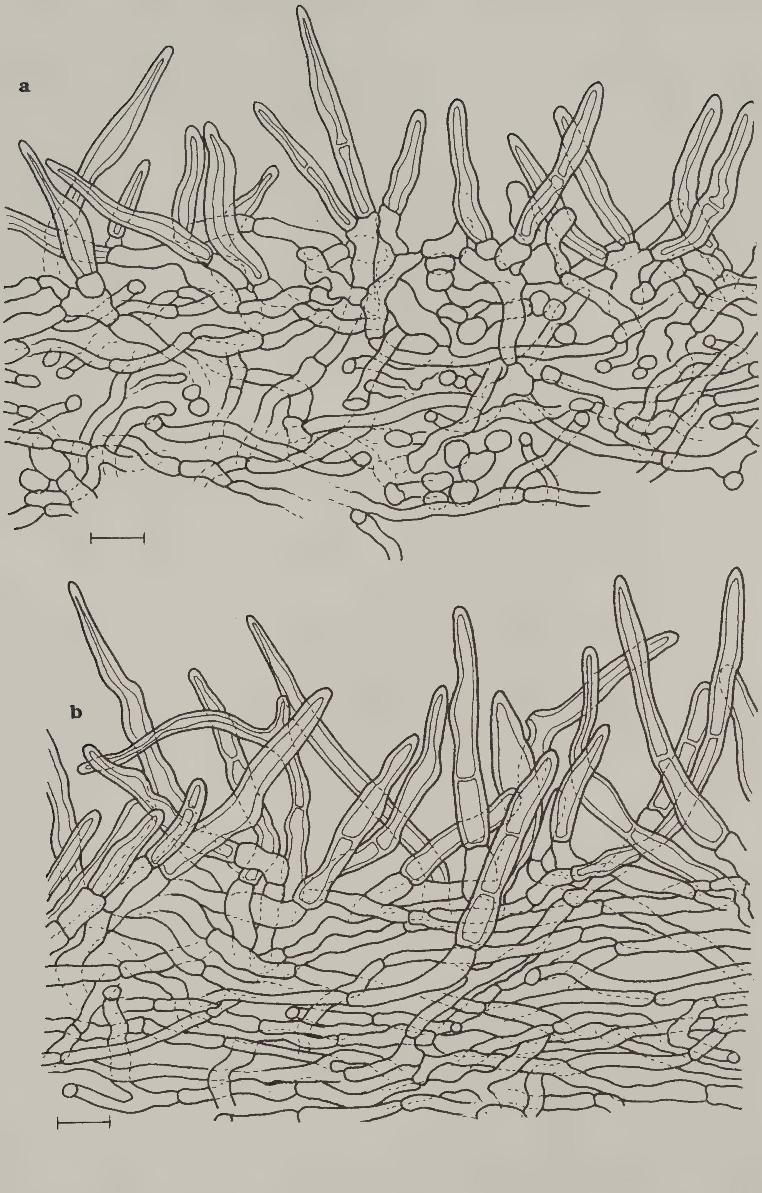

Fig. 6. *Lactarius pruinatus* (holotypus). a. section through the pileipellis, b. section through the stipitipellis (scale bar = 10 µm).

2.6. a checklist of the subgenus *Lactariopsis* in tropical Africa

(Remark: extended descriptions besides the original description are cited under "Select. descr." Countries where the species has been collected are listed alphabetically under "Distribution"; for each country, herbaria where material of the species is stored, are listed.)

annulatoangustifolius (Beeli) Buyck, Bull. Jard. Bot. Belg. 59: 241 (1989a).
Basionym: *Russula annulatoangustifolia* Beeli, Bull. Jard. Bot. Etat 14: 87 (1936).
Syn.: *Lactarius pandani* R. Heim, Candollea 7: 376 (1938); Prodr. Fl. Mycol. Madagascar 1: 37 (1938), nom. prov. (without lat. diagnosis); *Lactariopsis pandani* R. Heim, Rev. Mycol. (Paris) 2: 7 (1937), nom. prov. (without lat. diagnosis); *Lactarius pandani* R. Heim f. *aurantiacus* R. Heim, Bull. Jard. Bot. Etat 25: 18 (1955)
Misappl.: *Lactarius zenkeri* ss. Singer 1946
Holotypus: *Goossens-Fontana* 834 (BR).
Type locality: Zaire, Binga, N 02°28 E 20°31.
Select. descr. & figs.: Verbeken (1996a: 72).
Icon.: Heim (1938b: pl. 1a; 1955a: pl. 13, fig. 4; 1955b: pl. 1, fig. 1a-e).
Distribution: Cameroon (E, LY), Liberia (FH), Madagascar (PC), Zaire (BR), Zambia (herb. Buyck).

chamaeleontinus R. Heim, Bull. Jard. Bot. Etat 25: 87 (1955).
Holotypus: *Goossens-Fontana* 942 (BR).
Type locality: Zaire, Binga, N 02°28 E 20°31.
Icon.: Heim (1955a: pl. 15, fig. 8; 1955b: pl. 6, fig. 4a-c).
Distribution: Zaire (BR), Zambia (herb. Buyck).

heimii Verbeken, Bull. Jard. Bot. Belg. 65: 201 (1996).
Holotypus: *Verbeken* 94.465 (BR, isotypus GENT).
Type locality: Burundi, Rumonge Forest Reserve, Nyamirambo hill, S 04°07 E 29°37.
Icon.: Karhula et al. (1997).
Distribution: Burundi (BR, GENT, herb. Buyck), Malawi (K), Tanzania (H), Zambia (herb. Buyck).

indusiatus Verbeken, Bull. Jard. Bot. Belg. 65: 201 (1996).
Holotypus: *Verbeken* 94.122 (BR, isotypus GENT).
Type locality: Burundi, Rumonge Forest Reserve, Nyamirambo hill, S 04°07 E 29°37.
Select. descr. & figs.: this paper.
Distribution: Burundi (BR, GENT, herb. Buyck).

laevigatus Verbeken, Bull. Jard. Bot. Belg. 65: 203 (1996).
Holotypus: *Verbeken* 94.535 (BR, isotypus GENT).
Type locality: Burundi, Rumonge Forest Reserve, Nyamirambo hill, S 04°07 E 29°37.
Icon.: Karhula et al. (1997).
Distribution: Burundi (BR, GENT, herb. Buyck), Malawi (K), Zambia (herb. Buyck).

pelliculatus (Beeli) Buyck, Bull. Jard. Bot. Belg. 59: 242 (1989a).
Basionym: *Armillaria pelliculata* Beeli, Bull. Soc. Roy. Bot. Belgique 59: 111 (1927).
Syn.: *Lactarius pandani* R. Heim f. *intermedius* R. Heim, Bull. Jard. Bot. Etat 25: 20 (1955) ["var. *intermedius*" in Fl. Iconogr. Champ. Congo 4: 87 (1955), nom. nud.]; *Lactarius pandani* f. *pallidus* R. Heim, Bull. Jard. Bot. Etat 25: 17 (1955).
Holotypus: *Goossens-Fontana* 546 (BR).
Type locality: Zaire, Lisala, N 02°29 E 21°30.

Select. descr. & figs.: Heim (1955b, as "*pandani* f. *pallidus*" & "f. *intermedius*"), Verbeken (1996a: 56).
Icon.: Heim (1955a: pl. 13, fig. 2ab, 3 & 1955b: pl. 1, figs. 2-4).
Distribution: Zaire (BR).

pruinatus Verbeken & Buyck, this paper.
Holotypus: *Buyck* 3248 (GENT, isotypus herb. Buyck).
Type locality: Zambia, Kitwe, Chati-forest, S 12°49 E 28°12.
Distribution: only known from type locality.

sesemotani (Beeli) Buyck, Bull. Jard. Bot. Belg. 59: 241 (1989a)
Basionym: *Russula sesemotani* Beeli, Bull. Soc. Roy. Bot. Belg. 60: 169 (1928)
Lectotypus: *Goossens-Fontana* 505a (BR).
Type locality: Zaire, Diobo Akuba, N 02°37 E 20°50.
Select. descr. & figs.: Verbeken (1996a: 66).
Distribution: Burundi (BR), Ivory Coast (K), Malawi (K), Zaire (BR), Zambia (K, herb. Buyck).

velutissimus Verbeken, Bull. Jard. Bot. Belg. 65: 212 (1996).
Holotypus: *Verbeken* 94.291 (BR, isotypus GENT).
Type locality: Burundi, Rumonge Forest Reserve, Nyamirambo hill, S 04°07 E 29°37.
Icon.: Karhula et al. (1997); Ryvarden et al. (1994: 100, as *Lactarius pandani*).
Distribution: Burundi (BR, GENT, herb. Buyck), Kenya (K), Tanzania (H), Zaire (BR, herb. Thoen), Zambia (E, K, herb. Buyck).

zenkeri (Henn.) Singer, Ann. Mycol. 40: 111 (1942).
Basionym: *Lactariopsis zenkeri* Henn., Bot. Jahrb. Syst. 30: 51 (1902).
Excl.: *Lactarius zenkeri* ss. Singer (1946), = *L. annulatoangustifolius*.
Holotypus: *Zenker* 2230 (B, lost); neotypus: *Alexander* 16 (E).
Type locality: Cameroon, Bipindi, N 03°05 E 10°25; neotype locality; Cameroon, Korup NP, N 04°55 E 08°52.
Select. descr. & figs.: Verbeken (1996a: 50).
Distribution: Cameroon (E), Senegal (herb. Thoen).

3. RELATIONSHIP WITH THE GENUS *PLEUROGALA* NORVELL & REDHEAD

When Singer described *Lactarius panuoides* from Trinidad in a new section, the *Panuoidei*, he considered it to be a very interesting member of the genus, "quite isolated among the primitive *Lactarii* of the tropics and representing a distinctive element of the western tropics not paralleled by anything yet known from Africa or Asia." He mentioned a certain resemblance with the *Lactariopsidei* because of the thick-walled hairs in the pellis and the felty base of the stipe. Pegler (1983) also gave an extended description of this small, caespitose, lignicolous species collected on fallen twigs and debris. The clustered basidiocarps arose from an extensive thick mycelium covering the woody substratum. I checked this material and the mycelium is indeed very conspicuous while the basidiomes are very small. A first look at this exsiccatum would never make one think it concerns a *Lactarius*. Singer (1984) mentioned that the fungus is mostly taken for *Marasmiellus, Panellus* or *Pleurotus* when collected. Pegler (1983) pointed at a possible relationship with the sections *Lactariopsidei* and

Polysphaerophori because of the thick-walled hairs in the pileipellis, but in *L. panuoides* there are no sphaerocytes present in the trama.

In 1984, Singer described three more pleurotoid species in *Lactarius*: *L. uyedae, L. campinensis* and *L. igapoensis*. Especially in *Lactarius igapoensis* the parasitic character could be observed.

Redhead & Norvell (1993) consider *Lactarius* sect. *Panuoidei* sufficiently morphologically and biologically distinct to represent a separate genus (parasitic strategy on living wood tissue instead of the normally mycorrhizal strategy, the pleurotoid basidiomes, the poorly developed sphaerocyte bearing tissue and the tendency to produce a subiculum with thick-walled, skeletoid hyphae). They also prefer to retain the genus *Lactariopsis* as an independent lignicolous, velate genus in order to make *Lactarius* more homogeneous. I can accept the establishment of the genus *Pleurogala*, in contrast to Buyck (1995), but cannot agree with rehabilitating the genus *Lactariopsis* as it has been shown that the development is only secondary angiocarpic and as the earlier suggested saprophytic strategy is not acceptable to me.

3.1. personal observations

Pleurogala panuoides (Singer) Redhead & Norvell (Fig. 7-9)

Spores subglobose, 7-9 × 6-7 µm; ornamentation consisting of short and irregular ridges, aligned or connected and thus forming a subcomplete to almost complete reticulum with rather small meshes; ridges up to 0.7 µm high; plage completely and clearly amyloid; wall somewhat rugose between the meshes. *Basidia* 35-45 × 8-10 µm, 4-spored; sterigmata 7-9 × 1-2.5 µm. *Pseudopleurocystidia* very abundant, up to 8(10) µm wide, cylindrical or irregular, mostly rounded at the top and often branching, often thick-walled (wall 1-1.5 µm); content very refringent and granulose or guttate. *True pleurocystidia* absent. *Hymenophoral trama* consisting of hyaline, thin-walled hyphae; sphaerocytes lacking; lactifers abundant, often thick-walled. *Lamella-edge* fertile. *Pileipellis* composed of short chains of thin-walled subglobose elements mixed with long, slender, thick-walled hairs; hairs becoming much more frequent towards the lateral stipe, structure is then very close to a lamprotrichopalisade. *Subiculum* consisting of thick-walled, straight hyphae with some septae and very few branchings.

studied material: Guadeloupe — hygrophytic forest: Basse Terre, Trace de Sofaia, on fallen twigs and debris, 10-1977, *Pegler* 3133 (K). Trinidad — Naranja, 10-1949, *Dennis* 109 (K).

remarks

1. The totally amyloid plage is a character which has not been observed in any tropical African *Lactarius* species and is up to now only known from *Russula*. The thick-walled lactifers and pleurocystidia have never been observed before.

2. Deformed ornamentation which forms large globules on a spore, is often observed.

3. The pileipellis-structure strongly reminds the one present in the section *Chamaeleontini*.

Pleurogala igapoensis (Singer) Redhead & Norvell (Fig. 10-11)

Basidia 40-50 × 8-10 μm, 4-spored; sterigmata 5-9 × 1.5-2.5 μm. *Hymenophoral trama* composed of thin-walled hyaline hyphae and abundant lactifers; sphaerocytes absent. *Pseudopleurocystidia* abundant, thin-walled, but with thick-walled and refringent top, frequently branching. *True pleurocystidia* absent. *Lamella-edge* fertile. *Pileipellis* composed of short chains of thin-walled subglobose elements mixed with long, slender, thick-walled hairs; hairs becoming scarcer towards the margin of the small, pleurotoid pileus and much more frequent towards the lateral stipe, structure then very close to a lamprotrichopalisade.

studied material: Brazil — Amazonas, Igarapé do Tamumazinho, 04-1980, *Singer* B12126A (paratypus, F); ibid., *Singer* 12169 (F).

remarks

1. The spores of *Pleurogala igapoensis* could not be observed as the material was too young and only immature spores occurred. Therefore, I wonder if the observations made by Singer (1984) on this same material are accurate. The difference between *Pleurogala panuoides* and *P. igapoensis* is the height of the spore-ornamentation: 0.4-1.4 μm in *P. panuoides* and 0.4-0.5 μm in *P. igapoensis*. If this observation is indeed made on immature spores in the low ornamented species, the character becomes completely unreliable. It is beyond doubt that both species are closely related. Although some small differences are observed, I would not be surprised if the study of more collections would result in a synonymy of the species.

2. As the material is immature, numerous basidioles were observed and at the septa of these basidioles a very short bulge often occurs, which reminds somehow a clamp-connection.

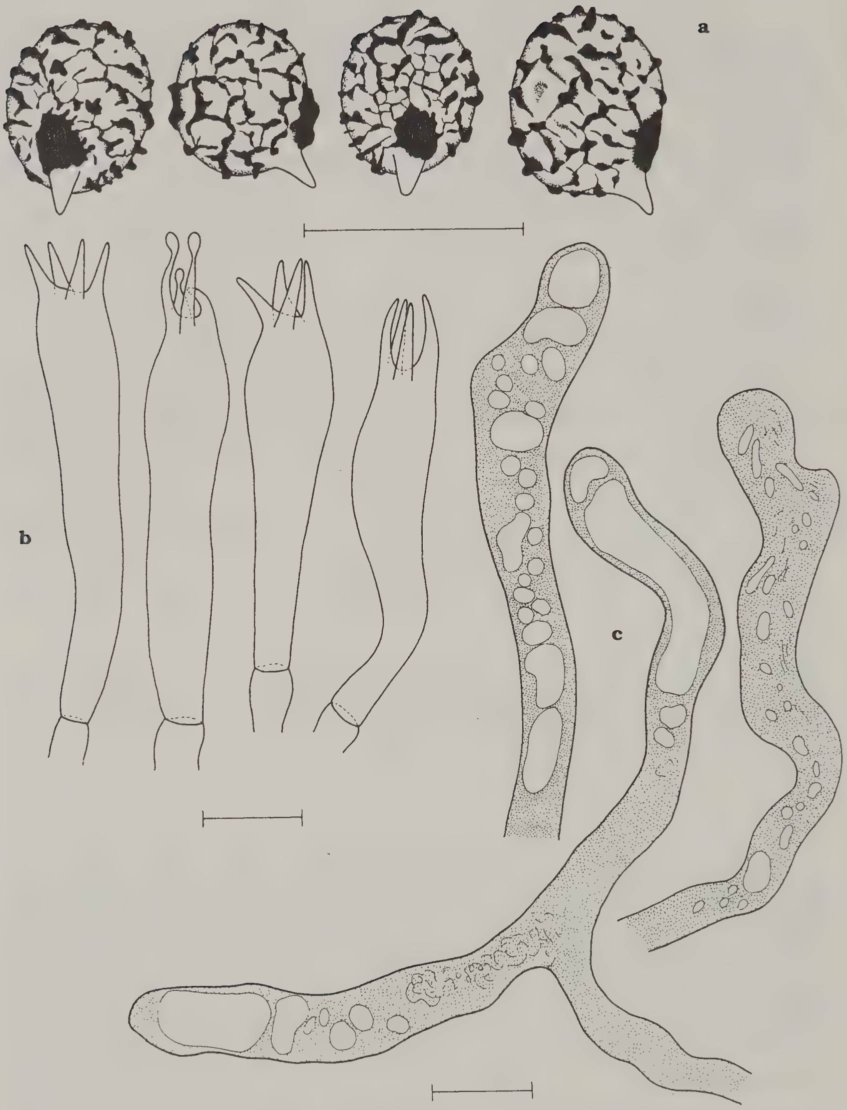

Fig. 7. *Pleurogala panuoides* (*Pegler* 3133). a. spores, b. basidia, c. pseudopleurocystidia (scale bar = 10 μm).

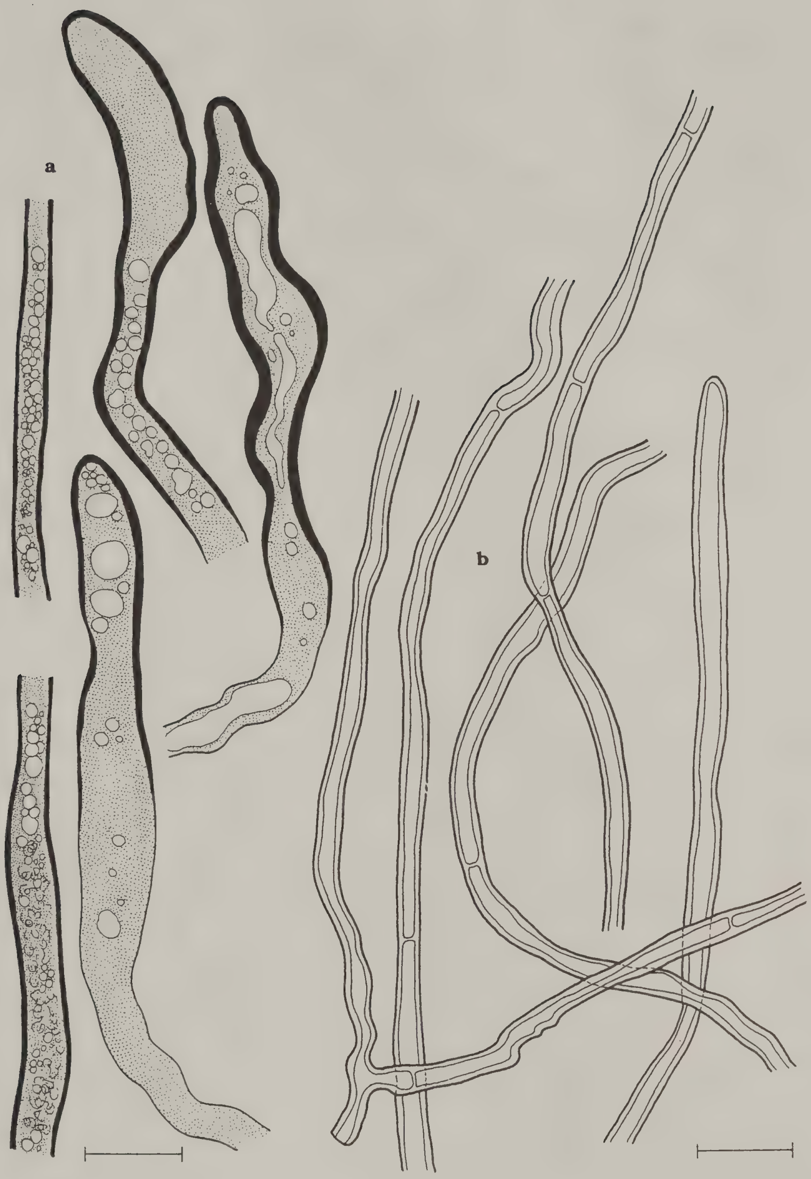

Fig. 8. *Pleurogala panuoides* (*Pegler* 3133). a. lactifers and pseudopleurocystidia, b. elements of the stipitipellis (scale bar = 10 μm).

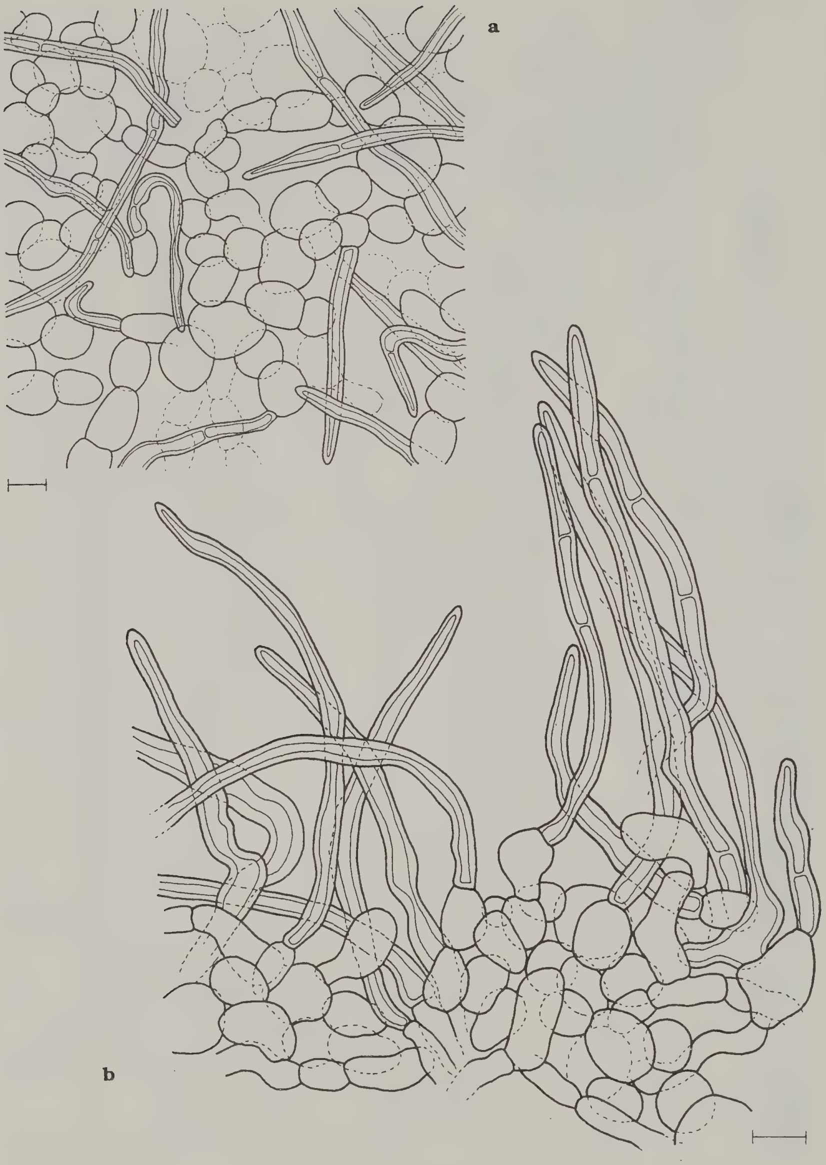

Fig. 9. *Pleurogala panuoides* (*Pegler* 3133). a. surface view of the pileipellis, b. section through the pileipellis (scale bar = 10 μm).

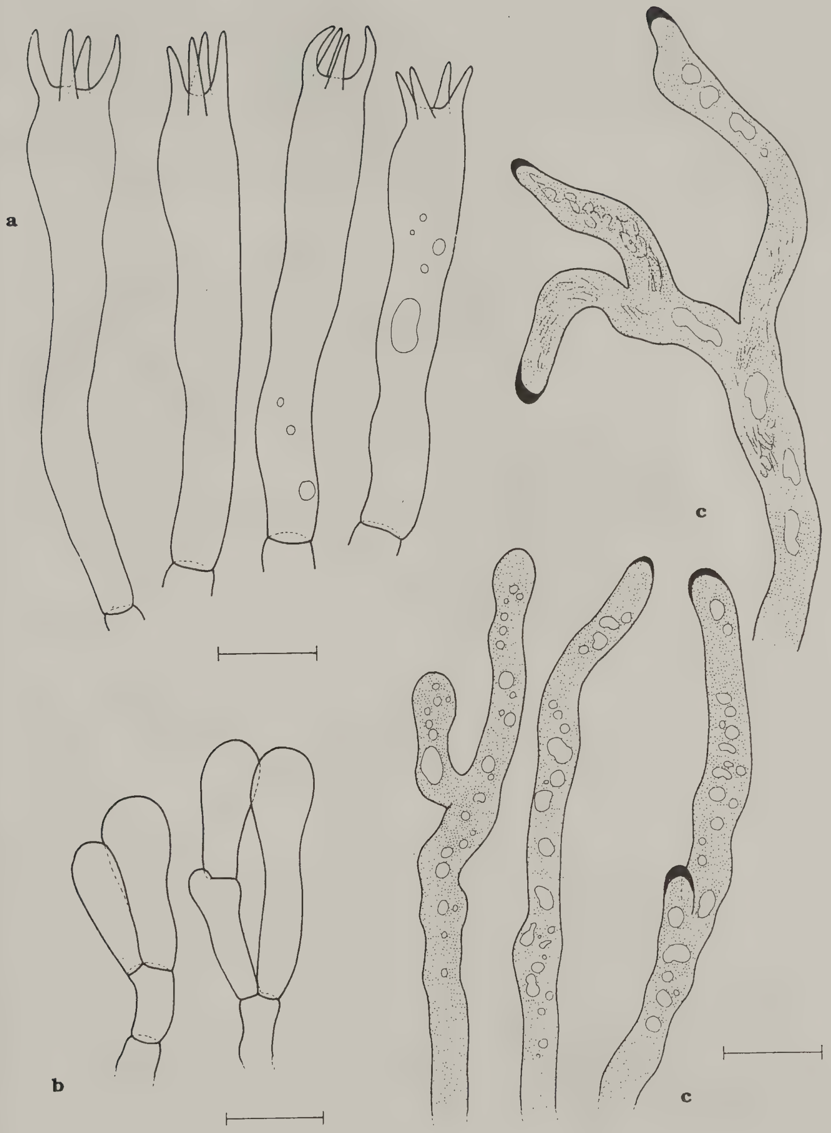

Fig. 10. *Pleurogala igapoensis* (*Singer* B 12126). a. basidia, b. marginal cells, c. pseudopleurocystidia (scale bar = 10 μm).

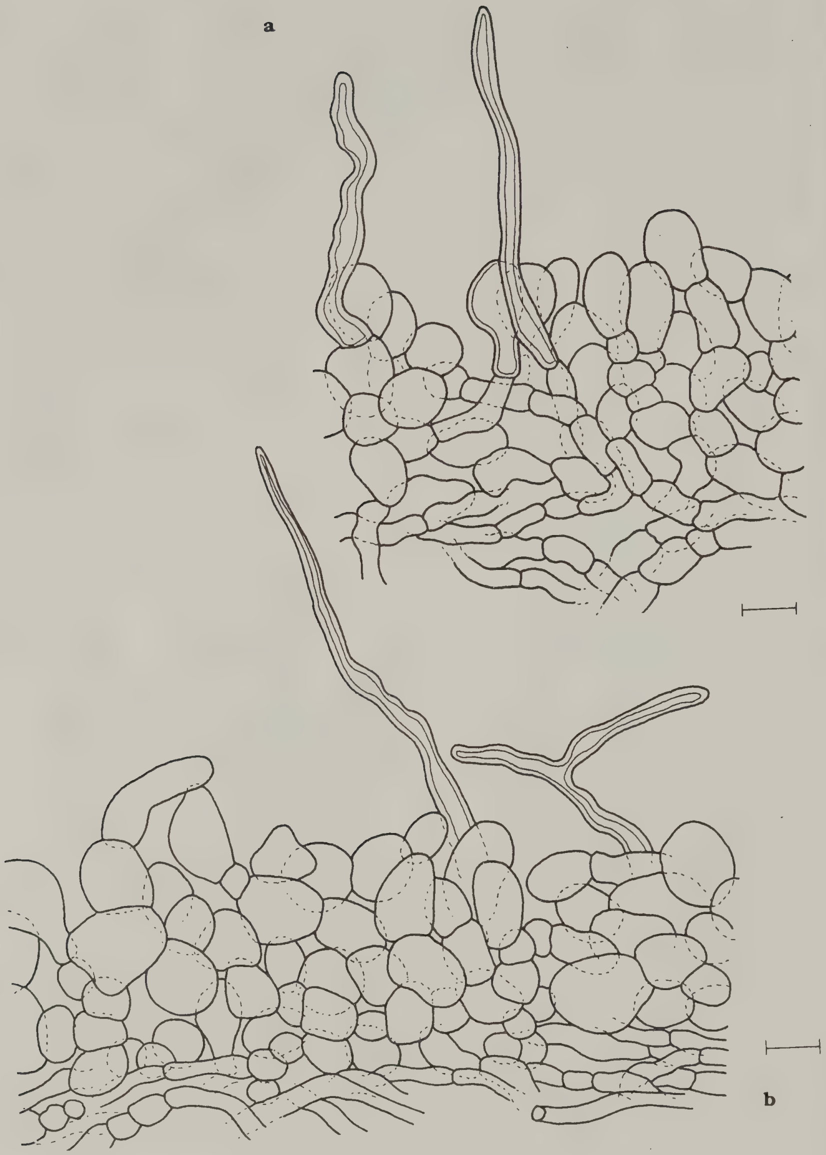

Fig. 11. *Pleurogala igapoensis* (*Singer* B 12126). sections through the pileipellis (scale bar = 10 µm).

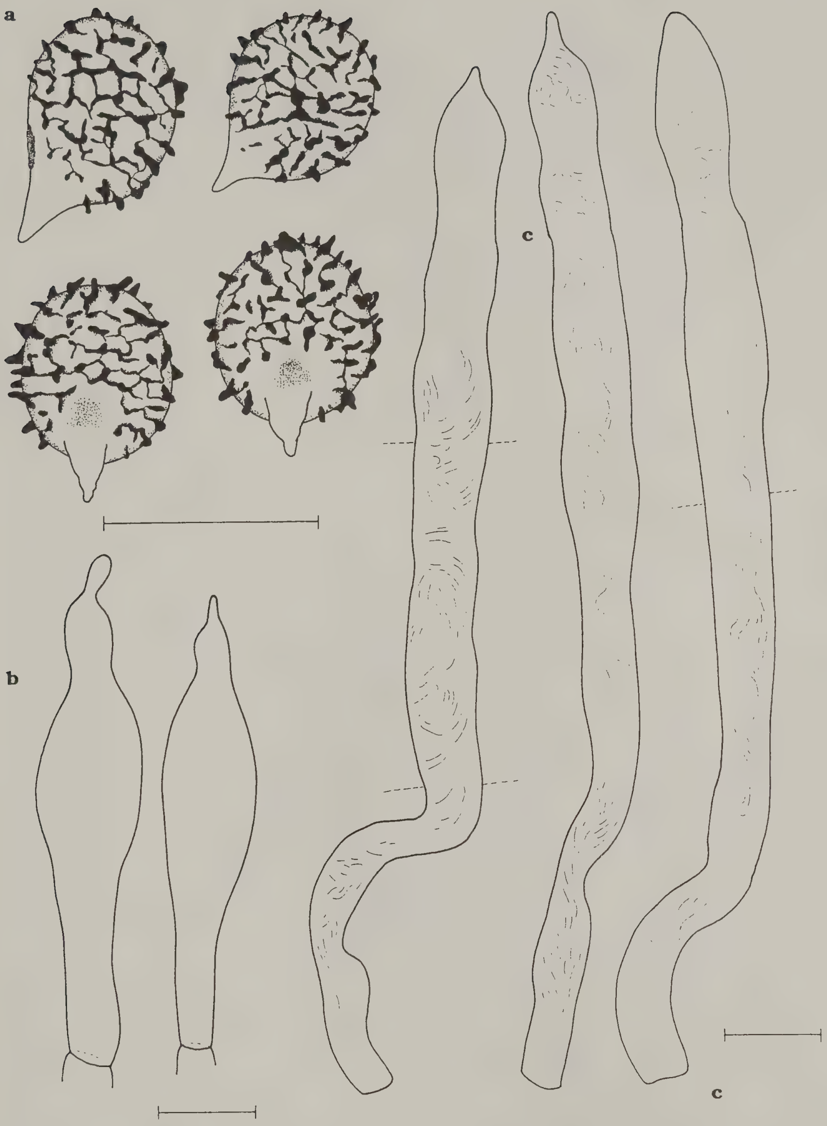

Fig. 12. *Pleurogala uyedae* (holotypus). a. spores, b. 1-spored basidia towards lamella-edge, c. true pleurocystidia (scale bar = 10 μm).

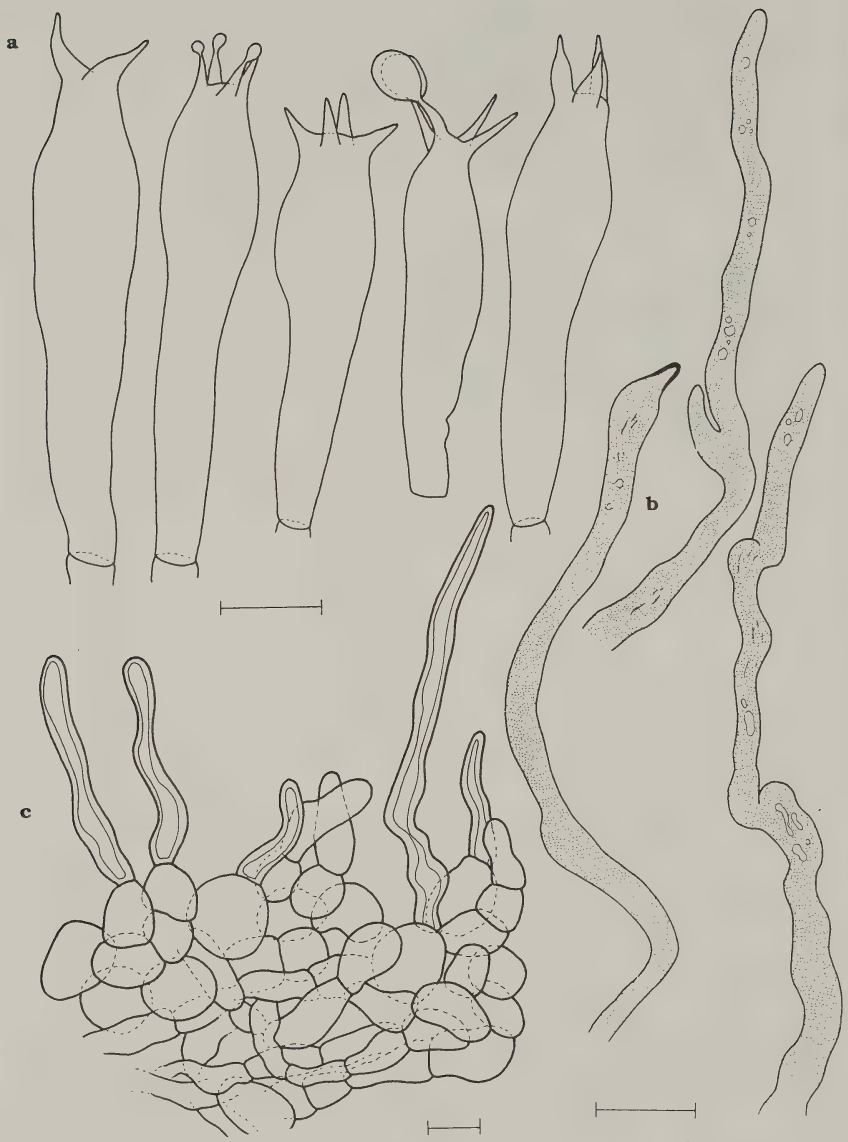

Fig. 13. *Pleurogala uyedae* (holotypus). a. basidia, b. pseudopleurocystidia, c. section through the pileipellis (scale bar = 10 µm).

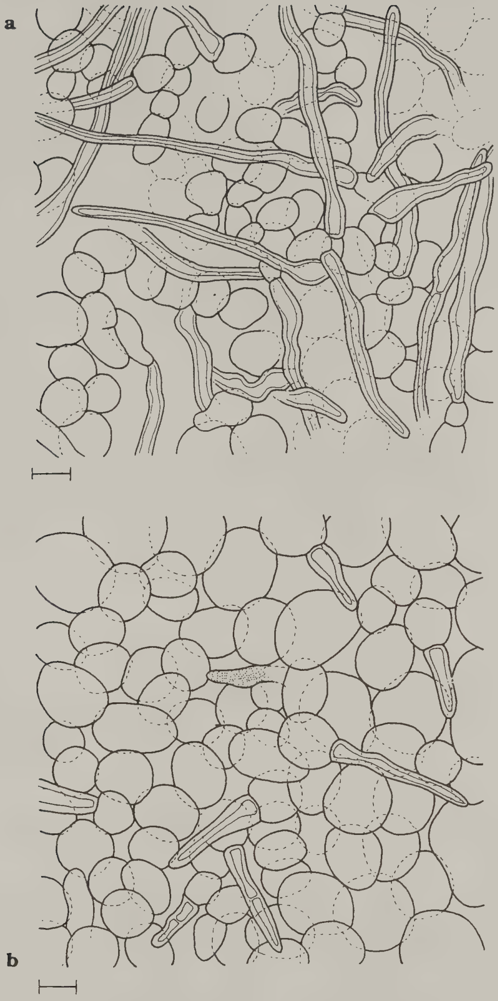

Fig. 14. *Pleurogala uyedae* (holotypus). surface view of the pileipellis. a. near the stipe, b. halfway radius (scale bar = 10 μm).

Pleurogala uyedae (Singer) Redhead & Norvell (Fig. 12-14)

Spores subglobose, 7.5-9 × 6-7 µm; ornamentation up to 1 µm high, consisting of a very dense, but irregular reticulum where irregular warts and short ridges are distinguishable and aligned or connected by finer lines; plage slightly, sometimes totally amyloid; hilar appendix very large and long, up to 4 µm. *Basidia* 35-50 × 9-11 µm, 4-spored, sometimes 2- or even 3-spored; sterigmata very slender and thin (if from 4-spored basidium), 5-7 × 1-2 µm. *Hymenophoral trama* consisting of subparallel, thin-walled and hyaline hyphae, thin-walled sphaerocytes and some lactifers. *Macropleurocystidia*abundant, emergent, 90-120 × 7-9 µm, long and cylindrical, often slightly moniliform at the top, with a needle-like content, arising very deep in the trama. Pseudocystidia not abundant, slender (2-4 µm diam.) and rather irregularly shaped, sometimes with small branches; content slightly refringent and at the top, which is sometimes a bit moniliform, often with a remarkable thicker and more refringent wall. *Lamellae-edge* fertile, but with some moniliform cystidia (or 1-spored basidia?) towards the edge. *Pileipellis* comparable with the one in *Pleurogala panuoides* and *P. igapoensis*, but with shorter and less acute hair-shaped elements.

studied material: Japan — Shiga, Otsu, Kokubu, 08-1973 to 09-1974, *Uyeda* s.n. (holotypus, F).

remarks

1. The long apiculus (up to 4 µm long) is the longest I ever observed in *Russulaceae*.

3.2. conclusion

Pleurogala can be considered as a separate genus better than including it in the genus *Lactarius* because of the following arguments:

- the species are shown to be parasitic rather than ectomycorrhizal (Singer, 1984), while all *Lactarius* species are ectomycorrhizal. No longer any belief is attached to the so-called saprophytic option of certain tropical *Lactarius* species growing on decaying wood.
- the pleurotoid habit, although never encountered as thus in the genus *Lactarius*, would indeed be a weak character to base a genus on it, but in combination with the abundant mycelium at the base, which consists of thick-walled 'skeletal' hyphae, and the almost complete lack of a stipe, this habit result in a group of fungi which are much more polypore-like than agaricoid. Even though there is some latex exuded from the basidiocarps, the species from the genus *Pleurogala* will never remind a *Lactarius* in the field. Much more connection with certain polypores, like *Bondarzewia*, is shown.

- some microscopical characters as the relatively few sphaerocytes in the trama, the totally and strongly amyloid plage, the thick-walled lactifers and thick-walled pseudocystidia are unknown in *Lactarius*.

It is beyond any doubt that both genera are closely related, this because of the almost unique features of exuding latex and having pseudocystidia. Although, before overestimating this relation, one should bear in mind that in species of the genus *Bondarzewia* the exuding of latex and the presence of pseudocystidia, is also observed (Verbeken, 1996c).

The closest connection to *Lactarius* species is up to now found in the subgenus *Lactariopsis*, because the species of the section *Chamaeleontini* have the same pileipellis-structure as the *Pleurogala* species.

Acknowledgements

I wish to express my gratitude to the directors and curators of the Herbaria referred to above for the loans of the studied material and to Bart Buyck and Daniel Thoen who kindly lent me their private collections; to M.E. Noordeloos and R. Walleyn for reviewing this paper.

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THE IDENTITY AND NOMENCLATURE OF MELIOLA ATALANTIAE

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Meliola atalantiae Hosag. is a latter homonym of *M.atalantiae* (Pat.) W. Yamam. and a new name, *M. cranei* Hosag. et Goos is proposed as a replacement.

Meliola bambusae was proposed by Patouillard (1888) for a parasite of *Bambusa* sp. (Poaceae) in Vietnam. Subsequently, Patouillard (1897) established *M. bambusae* Pat. var. *atalantiae* Pat. for a fungal pathogen on *Atalantia bilocularis* (Roxb.) Wallich (Rutaceae). Later, Yamamoto (1958) elevated this variety to the rank of species as *M. atalantiae* (Pat.) Yamam. Hansford (1946, 1961) unaware of Yamamoto's work and after examining the type material of *M. bambusae* var. *atalantiae* transferred this variety to *M. tenella* Pat. as var. *atalantiae* (Pat.) Hansf. Hosagoudar in Hosagoudar & Goos (1990) independently used the same epithet for a totally distinct species of *Meliola*. The corrected nomenclature of these two taxa is as follows:

1. **Meliola cranei** V.B. Hosagoudar et R.D. Goos, nom. nov.
≡ *Meliola atalantiae* Hosag. in Hosag. & Goos, Mycotaxon 37:220, 1990. Non Yamamoto, 1958.
Holotype: On leaves of *Atalantia wightii* Tanaka (Rutaceae), near Painavu, Feb. 19, 1983, V.B. Hosagoudar HCIO 40496.

2. *Meliola tenella* Pat. var. *atalantiae* (Pat.) Hansf., Proc. Linn. Soc. London 159:35, (1946) 1947; Sydowia Beih. 2:381, 1961.
≡ *Meliola bambusae* Pat. var. *atalantiae* Pat J.Bot. (Morot) 11:348. 1897.
≡ *Meliola atalantiae* (Pat.) Yamam., Sci. Rep. Hyogo Univ. Agric. Ser, Agric. Biol. 3:55, 1958. Non Hosagoudar in Hosagoudar & Goos, 1990.
Holotype: On leaves of *Atalantia buxifolia* Oliv., Tonkin, Bon 5206.

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NOTES ON HYPHOMYCETES. LXXIV. CONCERNING PARASTENELLA MAGNOLIAE, ITS PHYLOGENETIC AFFINITY, AND THE RELATIONSHIP BETWEEN IT AND ITS HOST, MAGNOLIA GRANDIFLORA

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ABSTRACT

Parastenella magnoliae (Weedon) J.C. David, previously reported as growing entirely superficially on leaves of *Magnolia grandiflora* L., is shown to penetrate leaves through stomata. Its hyphae are reported to spread intercellularly into leaf mesophyll and to aggregate in substomatal cavities to form loose stromatic tissue. The fungus, which is common in the southeastern United States, causes blotchy chlorotic discoloration of the adaxial leaf surface and may cause premature leaf drop. Comments are made on its taxonomy and probable phylogenetic affinities.

INTRODUCTION

The fungus presently known as *Parastenella magnoliae* was originally described as a species of the genus *Heterosporium* Klotzch ex Cook (Weedon, 1926), from a collection made on leaves of *Magnolia grandiflora* at St. Petersburg, Florida, U.S.A. At the time of its discovery some doubt was expressed as to its appropriate classification. Following the published description of the fungus, Weedon (loc. cit.) offered the following comment "This fungus differs from the typical *Heterosporium* in being superficial and perhaps for that reason should be regarded as a separate genus." An alternative classification was not, however, considered further. In regard to its subsequent taxonomy this statement was, as it turns out, both portentous and predictive but the presumed habit was, as re-

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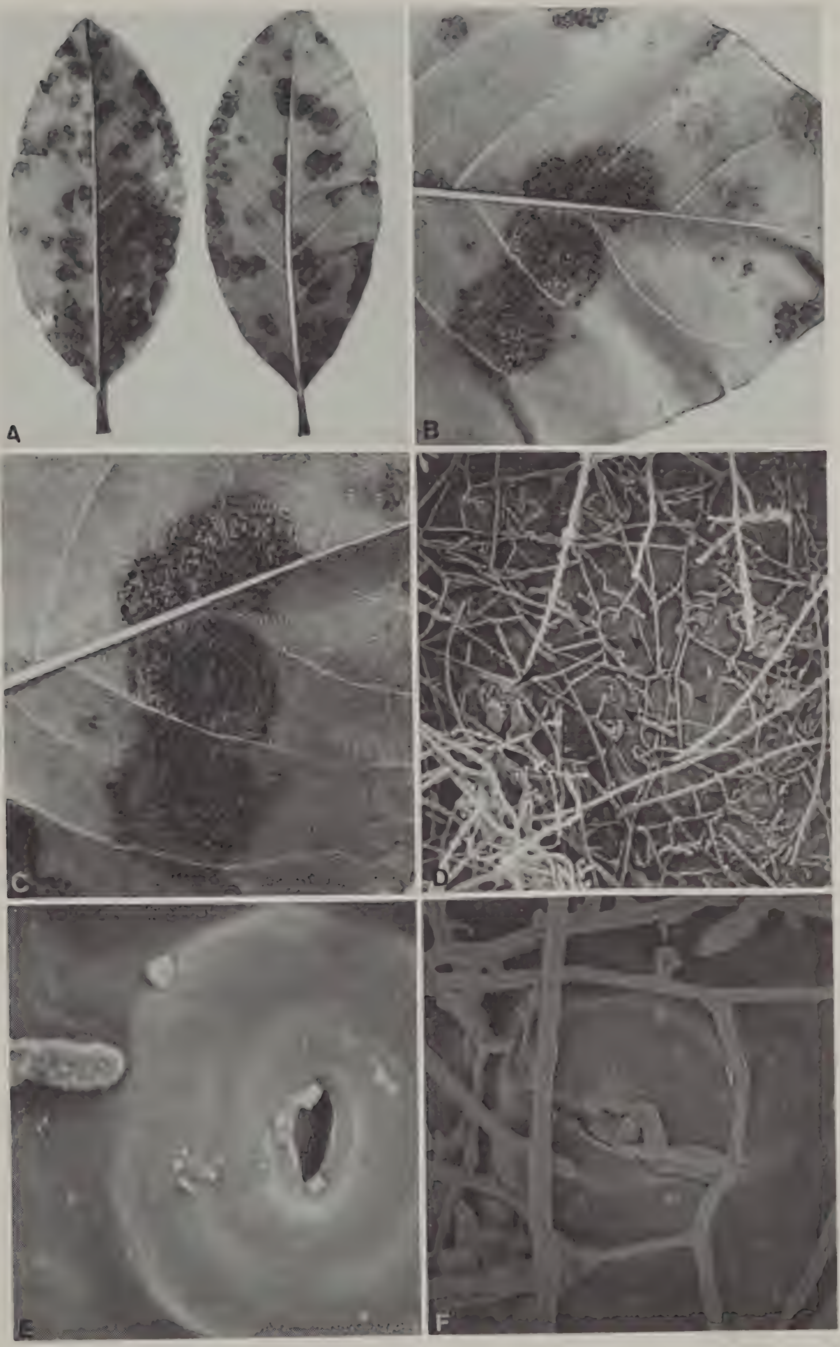
ported below, in part inaccurate. The fungus remained classified in *Heterosporium* for over half a century, until it was redescribed and illustrated by Morgan-Jones (1980) and transferred into a newly established genus, *Stenellopsis* Morgan-Jones. This generic name was coined to indicate the fact that the species has, morphologically, something of the aspect of *Stenella* Sydow, although it is not necessarily closely related to it. It was felt that the uniqueness of the taxon made its classification in a separate genus desirable, as previously suggested by Weedon (loc. cit.), though for reasons in addition to its presumed superficial habit and ecological specialization. The distinctions between it and other generic taxa lay not only in its host relationship but in conidium and conidiophore morphology, including unilateral nodose swelling of the latter, as well as peculiarities of conidiogenesis. Location of conidiogenous loci in relation to conidiophore growth, the presence of densely verruculose conidiophores, and lack of thickened conidial scars were noted to be particularly distinctive features (Morgan-Jones, loc. cit.).

By establishment of the generic name *Stenellopsis* Morgan-Jones a later nomenclatural homonym of the previously proposed *Stenellopsis* Huguenin, based on an entirely different fungus and dated some fourteen years earlier (Huguenin, 1966), was inadvertently and regretably created. David (1991) subsequently recognized the untenability of the homonym and established *Parastenella* J.C. David to replace it, while accepting the taxonomic decision made by Morgan-Jones (loc. cit.). Beyond an almost verbatim reiteration of the essential characteristics of the taxon, and the differences between it and *Stenella*, no new information was added, other than brief speculation as to likely affinity. An entirely superficial habit was again assumed and it was noted that the fungus grows among the indentum on the abaxial leaf surface, causing no noticeable lesions. *Parastenella magnoliae* occurs abundantly on *M. grandiflora* in the southeastern United States (Morgan-Jones, 1980, and more recent personal observations) and this has afforded opportunity for further study of the fungus from fresh collections. The results of additional investigation are reported herein, including some previously unknown details of host-pathogen relationship.

PLATE 1. *Parastenella magnoliae*. A-C, abaxial surface of host leaf bearing dark, more or less orbicular, discrete to confluent colonies; D, scanning electron micrograph (SEM) showing superficial network of repent hyphae with short, lateral branches penetrating stomata (indicated by small arrowheads), and stroma within a disrupted, exposed substomatal cavity (indicated by larger arrowhead) [X 250]; E, SEM of hyphal tip approaching a stoma [X 2700]; F, SEM showing verrucose superficial hyphae with a branch penetrating a partly disrupted stoma [X 1400].


A
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C
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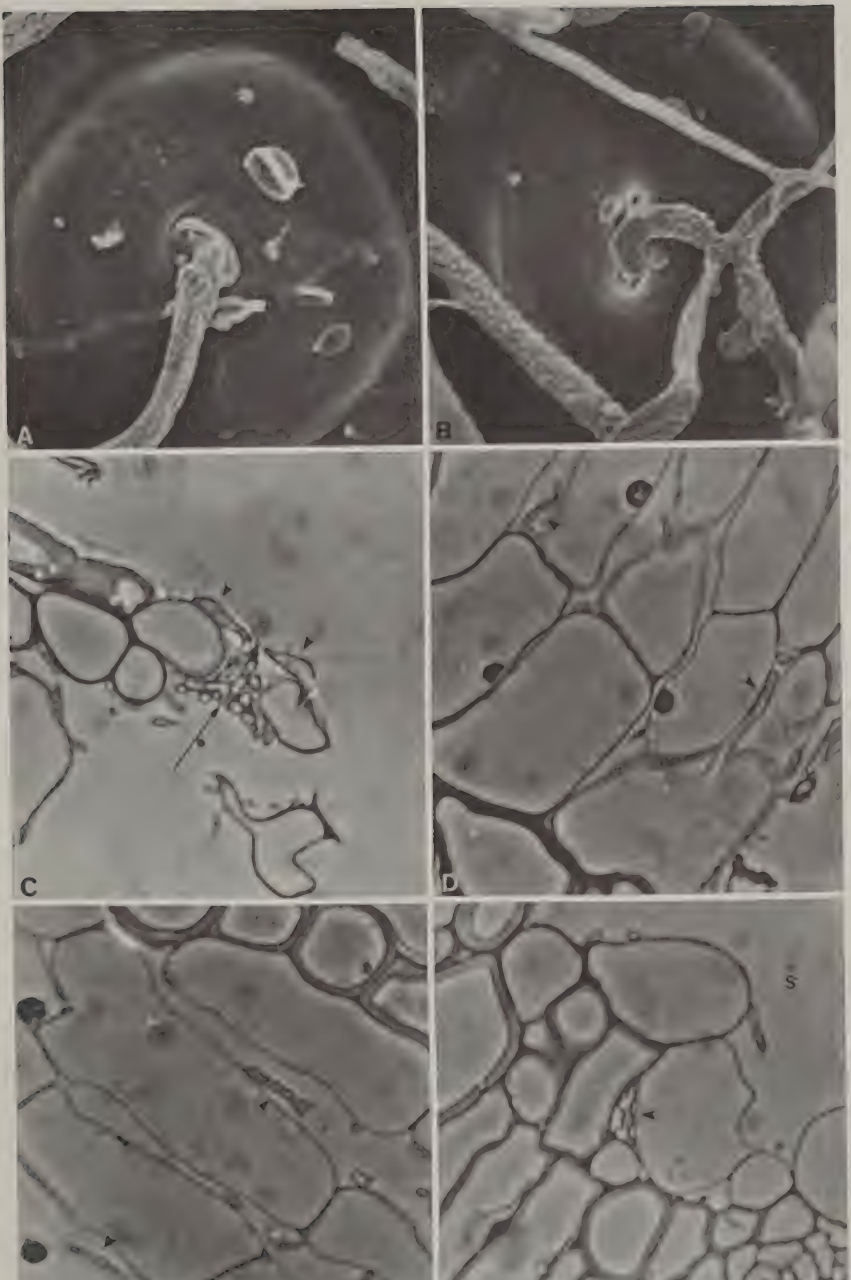
DESCRIPTIVE PART

Colonies of *Parastenella magnoliae* are usually numerous on infected leaves and, being quite prominent, are readily observed from mid summer to late fall. They are dark brown to blackish in coloration, scattered or gregarious, more or less orbicular, and eventually become confluent (Plate 1, A-C). A diameter of between two and three centimeters is normally reached under favorable conditions. On occasion entire abaxial leaf surfaces may become covered by colonies, particularly following leaf abscission and fall, when leaves are lying on the ground. No pronounced early host necrosis or any well-defined leaf lesion is associated with the presence of the fungus. In the initial stages of infection leaves remain totally symptomless but with increased fungal growth progressively larger, irregular, ill-defined, chlorotic blotches appear on adaxial leaf surfaces. Localized, orbicular, cinnamon-colored patches may sometimes occur. Eventually large, mottled areas become discolored and yellowish-brown following heavy infection and multiple entry. Fungal biomass buildup may ultimately result in premature browning, senescence and leaf abscission. Following conidial germination on the leaf surface an extensive, repent network of branched, verruculose hyphae is formed (Plate 1, D). Sustained growth is maintained by entry into the leaf. Individual hyphal tips of short lateral branches approach and penetrate leaf stomata (Plate 1, E & F; Plate 2, A & B). There appears to be no violation of the integrity of the leaf cuticle, at least at the time of first entry through the stomal aperture. As a result of further internal growth and proliferation eventually mycelium extends into the spongy mesophyll and even as far as the palisade mesophyll in proximity of the adaxial leaf surface, occupying intercellular spaces (Plate 2, D-F). Host plant cell walls do not appear to be adversely affected structurally. In older leaves internal hyphal may be quite extensive and loosely organized stromatic tissue, reminiscent of that occurring in some species of *Pseudocercopora* Speg., sometimes forms in substomatal cavities, often partly in the vicinity of guard cells (Plate 2, C). In some instances this results in a forcible tearing apart of the guard cells and disruption of the stoma to such an extent as to expose the underlying, developing stroma ((Plate 1, D & F). Dense, progressively ra-

PLATE 2. *Parastenella magnoliae.* A & B, scanning electron micrographs showing hyphal penetration of stomata [X 2500]; C-F, light microscope photographs of infected host leaf in cross section [X 850]; C, stoma on abaxial surface with guard cells (indicated by arrow heads) and underlying stroma (indicated by arrow); D & E, intercellular hyphae (indicated by arrowheads) among mesophyll cells; F, intercellular hypha (indicated by arrowhead) between mesophyll cells in proximity of a substomatal cavity (s).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diating, external fungal colonies are clearly supported by internal nutrient acquisition, as well as, presumably, leaf surface exudates. The conidiophores of *P. magnoliae* arise either terminally or laterally from superficial hyphae and are scattered.

DISCUSSION AND COMMENTS ON AFFINITY

In the matter of the details of the host-pathogen relationship *Parastenella magnoliae* is clearly not as uniquely different from other morphologically similar genera and species as was once thought. In fact, although its host specificity and the ecological niche that it occupies point to distinctiveness, its habit is not unlike that of the majority of the fungi belonging to the *Cercospora*-complex, except that it predominantly produces a dense network of hyphae that are external and superficial on the leaf surface, in addition to the far less extensive immersed intercellular mycelium. The latter may not constitute as large a portion of the total biomass as is usual in most similar fungi, but a continuum in this regard occurs within this group of fungi. A genus such as *Mycovellosiella* Rangel, where there is no stromal development, or where this is merely rudimentary, has mycelium that is partly superficial and partly immersed. In *Stenella*, where a stroma is usually present but is generally small and superficial, most of the mycelium is normally external to the leaf and the hyphae are verruculose, as they are in *Parastenella*. In the genus *Ramularia* Unger a number of species form extensive external secondary mycelium on leaf surfaces (Braun, 1990; Srivastava *et al.*, 1995), in contrast to others that form stromata from which fascicles of conidiophores are produced. These taxa are essentially identical to species of *Mycovellosiella*, and most were classified in that genus by Deighton (1974, 1979), differing from them only in lack of pigmentation. Finally there are those genera, such as *Cercospora* Fres., *Cercosporidium* Earle, and *Pseudocercospora* Speg., where the mycelium is mostly or entirely immersed in the host mesophyll and well-developed stromata are usually present.

Insofar as symptomatology is concerned, *P. magnoliae* is not dissimilar to some other species of this complex. The lack of a necrotic leaf lesion associated with invasion of the leaf tissue is a characteristic that it has in common with some species of such genera as *Pseudocercosporella* Deighton and *Stenella*. In the former, as pointed out by White *et al.* (1990), some taxa cause distinct, necrotic lesions and bear well-developed stromata, whereas others have a more benign relationship with their hosts and leaf spots are absent.

With regard to possible phylogenetic affinity, Morgan-Jones (loc.cit.) pointed out the significant differences between *Parastenella magnoliae* and species of *Stenella*, while noting that the conidiophores of the former bear some resemblance to those of *Fulvia fulva* (Cooke) Ciferri, the type species of *Fulvia* Ciferri, a genus classified by von Arx (1983) as a synonym of *Mycovellosiella*. In particular, *F. fulva* bears conidiophores with unilateral nodose swellings and conidiogenous cells which are largely intercalary, both characteristics also possessed by *Parastenella*. David (1991) considered *Fulvia* to be closer to *Mycovellosiella* and *Phaeoramularia* Muntañola than to *Parastenella* and, moreover, suggested that the latter seemed to be more similar to such genera as *Hadronema* Sydow, *Melanographium* Sacc., and *Virgariella* Hughes, or *Pseudocercospora*, based on characters in the key to dematiaceous Hyphomycetes published by Ellis (1976). It is highly unlikely, however, that *Parastenella* is closer to these latter genera since they are, particularly the first three, morphologically very different from it. Their conidia bear no resemblance whatsoever to those of *Parastenella*. *Pseudocercospora*, as characterized by its type species *P. vitis* (Lév.) Speg., has broad, unthickened conidiogenous loci that somewhat resemble those of *Parastenella* but, again, the two genera differ appreciably in other aspects of morphology. De Hoog (1992), in redescribing *Cladosporium anomalum* Berk. & Curt., which he reclassified in *Pseudocercospora* [as *P. anomala* (Berk. & Curt.) de Hoog], pointed out that it is similar to *Parastenella* but differs from it in having conidiophores that are coarsely ornamented and conidia that arise in small groups from somewhat protruding scars.To some degree *P. anomala* can, perhaps, be viewed as an intermediate form between *Parastenella* and the main body of *Pseudocercospora*, a genus which is considered to be heterogenous as presently constituted (Sutton and Pascoe, 1988; Morgan-Jones and Phelps, 1996).In any critical revision of *Pseudocercospora* it is clear that *P. anomala* would be a candidate for classification eleswhere, possibly accommodated in a genus of its own. In so far as *Parastenella* is concerned it seems probable that it belongs to the *Mycosphaerella* Joh., anamorph complex. Its relatedness cannot, beyond that, be at present determined.

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SOME NEW SPECIES AND NEW RECORDS OF DISCOMYCETES IN CHINA. VIII*

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ABSTRACT Several collections from Jiangxi, Heilongjiang and Beijing were examined. Among them, *Lachnum lushanense* is described as new and a possible new species is treated under *Microglossum* sp. Nine discomycetes are recorded for the first time from China. Name changes of three previously reported species are noted.

NEW SPECIES

Lachnum lushanense W. Y. Zhuang & Z. Wang, **sp. nov.** (Fig. 1)

Ab *Lachno gahniae* apotheciis 0.4-1.2 mm diam, stipitibus longis, pilis substantiis sanguineis amorphisque praeditis, ascis 45-50 x 3.5-4.5 um, ascosporis guttulatis, non-septatis, 12-18 x 1.0-1.5 um differt.

Apothecium gregarious, discoid, long-stipitate, 0.4-1.2 mm diam; hymenium white, receptacle white and surface covered with hairs which are cemented with a red amorphous matter; stipes white, 1-2 times of disc diam in length, covered with similar hairs. Hairs cylindrical, granulate, subhyaline, covered with or upper portion capped by red, amorphous, resinous matter which is dissolved gradually in cotton blue lactophenol and aqueous KOH solution, 2-5-septate, 45-100 x 3 µm. Ectal excipulum of textura prismatica, 20-30 µm thick; cells hyaline, somewhat refractive, 4-23 x 3-7 µm. Medullary excipulum of textura intricata, 25-150 µm thick; hyphae hyaline, 2-3 µm wide. Subhymenium 15 um thick. Hymenium 50-58 µm thick. Asci 8-spored, clavate, J+, pore walls blue in Melzer's

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reagent, 45-50 x 3.5-4.5 µm. Ascospores mostly biseriate, narrowly fusoid, with pointed ends, hyaline, non-septate, with a few small guttules, 12-18 x 1.0-1.5 µm. Paraphyses lanceolate, with a pointed apex, 1.5-2.0 µm wide, exceeding asci 5-8 µm.

Holotype: on dead leaf sheath at stem base of an unknown grass, Lushan Mountains, Jiangxi Province, W.-y. Zhuang & Z. Wang (1462), 1996 X 18, HMAS 71903.

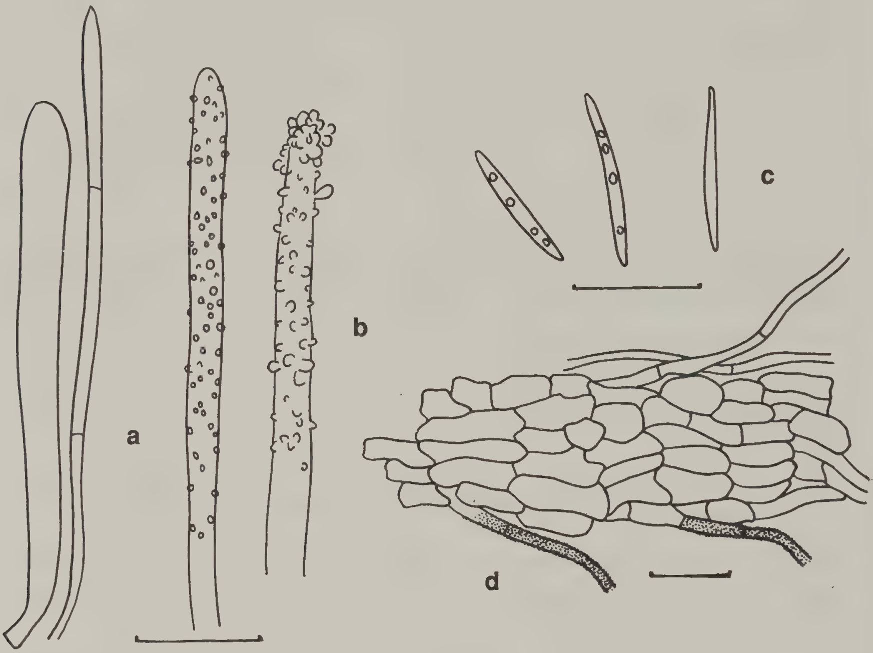

Fig. 1. *Lachnum lushanense:* **a**. ascus and a paraphysis; **b**. hairs, left mounted in cotton blue lectophenol showing granules on surface, right mounted in water showing amorphous matter on upper portion of a hair; **c**. three ascospores; **d**. ectal excipular structure; **a**, **b**, **c** scale = 10 µm, **d** scale = 20 µm; all from holotype.

Notes: This species is similar to *Lachnum gahniae* Spooner (1987) in the shape of ascospores, shape and width of paraphyses, size of hairs, and presence of amorphous, resinous matter on tops of hairs. The former differs from the latter in long-stipitate and larger apothecia (0.4-1.2 mm vs. 0.3-0.45 mm in diam), hairs on receptacle and stipe covered with red, resinous, amorphous matter instead of hyaline or amber-colored substances, smaller asci [45-50 x 3.5-4.5 µm vs. (58-)61-67(-84) x 5.5-6.5(-7.5) µm] and ascospores [12-18 x 1.0-1.5 µm vs. (17-)20-23(-25) x

1.5-2.0 µm]. *Lachnum gahniae* is on dead leaves of *Gahnia clarkei* (Cyperaceae) in Victoria, Australia, while *Lachnum lushanense* is on dead leaf sheath at stem base of an unknown graminaceous plant in Lushan Mountains, Jiangxi Province, China. The two species may be closely related.

Lachnum lushanense is characterized by red hairs on the receptacle and stipe surface and white hymenium in gross morphology and its narrowly fusoid ascospores. The red, amorphous, resinous matter on hairs is dissolved gradually in aqueous KOH solution and in cotton blue lactophenol but is maintained in water.

Microglossum sp. (nov.?)

Ascocarps solitary, stipitate, ascogenous portion capitate, black, about one sixth of the total length, 6 x 4 mm when fresh, compressed when dry; stipe hairy, 30 x 2 mm. Hairs distributed on stipe, cylindrical with a blunt apex and a swollen base, dark brown, non-septate, 14-50 x 6.5-7.5 µm. Medullary excipulum of textura intricata, hyphae light brown, 4-13 µm wide. Asci 8-spored, J+ in Melzer's reagent, 237-259 x 20-23 µm. Ascospores cylindrical, sometimes more or less narrow at lower end, hyaline, with (4-)10-16 septa, 84-150 x 4.0-4.6 µm. Paraphyses slightly enlarged at apex, apical cell light brown and encrusted by brown matter, 5.5-8.5 µm wide at apex and 5.0 µm wide below.

Specimen examined: on the ground among mosses, Dajing, Jinggang Mountains, Jiangxi Province, Z. Wang & W.-y. Zhuang (1499), 1996 X 23, HMAS 71904.

Notes: One apothecium was collected. The fungus is similar to *Microglossum longisporum* Durand in the cylindrical, permanently hyaline and not very thin-walled ascospores but differs from the latter in presence of only one type of ascospores which are longer [84-150 µm long vs. (34-)68-85(-95) µm long], ascocarp black and capitate when fresh, and paraphyses much broader and encrusted by brown matter at apical cells which are light brown instead of hyaline. The concept of *Microglossum* Gillet accepted here follows the treatment by Imai (1941) and Mains (1955). This fungus may be placed in the genus *Theumenidium* Kuntze by some authors since the presence of brown amorphous matter encrusted the apical portion of paraphyses.

In the genus *Geoglossum* Pers., *Geoglossum alveolatum* (Rehm) E. J. Durand has similar spore size, shape and septation to HMAS 71904. But the ascospores of the former are usually very thin-walled and display a tint of pale brown at full maturity (Mains, 1954; Zhuang & Wang, 1997). The concepts and delimitation of *Microglossum*, *Theumenidium*, and *Geoglossum* need to be investigated further.

The fungus is certainly new but not going to be published as a new species since the material is to poor to be a type.

NEW RECORDS FOR CHINA

Chlorencoelia torta (Schwein.) Dixon, Mycotaxon 1: 237, 1975.

Diagnostic features: Apothecia gregarious, discoid to infundibuliformis, stipitate, 10-20 mm in diam.; hymenium clay-yellow, dirty yellow to brownish yellow; receptacle yellowish brown to brown, surface pustulate; stipes brown, brownish yellow or brown with a greenish tint, 8-15 mm long. Ectal excipulum of textura angularis, 30-45 µm thick excluding pustules, cell walls pale yellow; pustules brown, cells isodiametric to club-shaped, walls pale brown. Medullary excipulum of textura intricata, 120-380 µm thick or thicker, hyphal walls pale yellow to pale brown. Hymenium 115-125 µm thick. Asci 8-spored, J+ in Melzer's reagent, pore walls strongly blue. Ascospores ellipsoid, uniseriate to irregularly biseriate, biguttulate, ca 10-11 x 3.3 µm. Paraphyses cylindrical, hyaline, 2 µm wide.

Specimen examined: on wet wood, Liangshui, Heilongjiang Province, W.-y. Zhuang & Z. Wang (1282), 1996 VIII 27, HMAS 71905.

Geopyxis cf. **majalis** (Fr.) Sacc., Syll. Fung. 8: 72, 1889.

Diagnostic features: Apothecia discoid to cupulate, subsessile, 10-24 mm in diam.; margin minutely crenulate and extended somewhat beyond the hymenium; hymenium apricot-yellow. Ectal excipulum of textura angularis, 40-50 µm thick, cells 10-35 x 10-22.5 µm. Medullary excipulum of textura intricata, 300-500 µm thick. Subhymenium ca. 50 µm thick. Hymenium 210-230 µm thick. Asci 8-spored, J- in Melzer's reagent, 160-195 x 10-11.5 µm. Ascospores broadly ellipsoid and blunt at ends, uniseriate, eguttulate, contents refractive, 11.5-14.0 x 6.5-7.5 µm. Paraphyses simple, less than 2 µm wide.

Specimen examined: on duff and soil, Baihua Mountains, Beijing, alt. 1200 m, W.-y. Zhuang & Z. Wang (1198), 1995 IX 18, HMAS 71797.

Notes: The gross morphology and ascospore shape of this fungus are similar to *Geopyxis majalis*, whereas its spore size is close to that of *Geopyxis carbonaria* (Alb. & Schwein. : Fr.) Sacc. (Rifai, 1968; Dennis, 1978). The fungus agree with *Geopyxis* cf. *majalis* described by Garnweidner et al. (1991).

Helvella cf. **philonotis** Dissing, Bot. Tidsskr. 60: 117, 1964.

Diagnostic features: Apothecia saddle-shaped, stipitate, pileus about 30 x 20 mm; hymenium dark gray when dry; receptacle light brownish yellow when dry, surface smooth; stipes with furrows extending to receptacle surface and not reaching the margin. Ectal excipulum of textura angularis, 50-100 µm thick. Medullary excipulum of textura intricata, 300-400 µm thick. Hymenium 300-320 µm thick. Asci 8-spored, J- in Melzer's reagent. Ascospores ellipsoid, uniseriate, uniguttulate, hyaline, mostly 17.5-20 x 12-12.5 µm. Paraphyses cylindrical, 4-5 µm wide.

Specimen examined: on soil, Dongling Mountains, Hebei Province, Y.-z. Wang, W.-y. Zhuang & Z. Wang (1589), 1995 VIII 11, HMAS 71777.

Notes: The receptacle color of HMAS 71777 is too light for *Helvella philonotis* (Dissing, 1966).

Heyderia abietis (Fr.) Link, Handb. Erkenn. Gewaechse 3: 311, 1833.

Diagnostic features: Apothecia elongate-conical to subcylindrical, stipitate, 1.2-3.0 x 0.8-1.1 mm; hymenium yellow; stipes brown, 7-16 mm long. Ectal excipulum of textura prismatica, ca 50 µm thick, cells 15-25 x 6.5-7.5 µm, walls strongly roughened, pale brown. Medullary excipulum of textura intricata, hyphal walls strongly roughened, hyphae 3-8 µm wide. Subhymenium slightly pigmented. Hymenium 66-76 µm thick. Asci 8-spored, J+ in Melzer's reagent, pore walls strongly blue, 56-61 x 5-6.3 µm. Ascospores elongate-fusoid, biseriate, with two to more small guttules, 12-16.5 x 1.6-2.2 µm. Paraphyses subcylindrical, hyaline, 2.5-3.5 µm wide.

Specimens examined: on *Picea* needles, Liangshui, Heilongjiang Province, alt. 400 m, W.-y. Zhuang & Z. Wang (1345), 1996 VIII 30, HMAS 71954; on needles of *Abies* and *Picea*, Liangshui, Heilongjiang Province, alt. 400 m, W.-y. Zhuang & Z. Wang (1377), 1996 VIII 31, HMAS 71955.

Notes: Following Maas Geesteranus (1964), Korf (1973) and Dennis (1978), the generic name *Heyderia* Link is accepted. Two collections from Liangshui Forestry Station, Heilongjiang Province fit the species concept of *Heyderia abietis* (Mains, 1955; Dennis, 1978). The ascospores of the Chinese collections are slightly narrower than the European and North American material.

Hymenoscyphus lasiopodium (Pat.) Dennis, Persoonia 2: 190, 1962.

Diagnostic features: Apothecia discoid, stipitate to subsessile, 2-5(-10) mm in diam.; hymenium orange-yellow; receptacle paler than hymenium; stipes up to 4 mm long. Ectal excipulum of textura prismatica to textura angularis, ca 50-85 µm thick. Medullary excipulum of textura intricata, 170-500 µm thick. Asci 8-spored, J+ in Melzer's reagent, 135-165 x 7.5-12.0 µm. Ascospores fusoid, irregularly uniseriate, with 1-3 septa, multiguttulate, 20-28(-30) x 3.5-5.0 µm. Paraphyses subcylindrical, 2.5-3.5(-4.5) µm wide.

Specimens examined: on root (or stem base) of a grass, Baihua Mountains, Beijing, alt. 1200 m, W.-y. Zhuang & Z. Wang (1195), 1995 IX 18, HMAS 71819; on roots of a grass, Baihua Mountains, Beijing, alt. 1200 m, W.-y. Zhuang & Z. Wang (1221), 1995 IX 19, HMAS 71820; on stems of a grass, Baihua Mountains, Beijing, alt 1200 m, W.-y. Zhuang & Z. Wang (1255), 1995 IX 20, HMAS 71821.

Notes: According to Dumont & Carpenter (1982), *Hymenoscyphus lasiopodium* is often distributed in the tropics, found on wood and rarely on herbaceous stems in very wet areas and with smaller apothecia. The three Chinese collections are all from Baihua Mountains, Beijing (temperate region), found on root or stem base of an unknown grass, and with larger fruitbodies (apothecial diameter: 3-4 mm vs. 1-1.5 mm) and asci [135-165 x 7.5-12 µm vs. (90-)110-115(-130) x 6-8(-10) µm]. The ascospore characters fit well those of the tropical collections. The morphology of the fungus might be influenced by the geographical conditions.

Lachnum cf. **calosporum** (Pat. & Gaill.) Haines & Dumont, Mycotaxon 19: 21, 1984.

Diagnostic features: Apothecia discoid, stipitate, 1-4 mm in diam when dry; hymenium orange-yellow when dry; receptacle with brown hairs; stipes about 1 mm long. Ectal excipulum of textura porrecta, 30-50 µm thick. Medullary excipulum of textura intricata, 70-100 µm thick; hyphae somewhat parallel. Hymenium 150-170 µm thick. Asci 8-spored, J+ in Melzer's reagent, pore walls weakly blue, 62.5-105 x 7.5-10 µm. Ascospores filiform, with one end broader, with 5-14(-17) septa, 50-80(-100) x 2.0-2.5 µm. Paraphyses lanceolate, 2.5-5 µm wide.

Specimens examined: on twigs, Dongling Mountains, Hebei, X.-q. Zhang (2031) 1996 VIII, HMAS 71785; on bark, Dongling Mountains, Hebei, Y.-q. Huang & W.-y. Zhuang (1590, 1591), 1996 VIII, HMAS 71786, 71787.

Notes: Compared with the typical material (Haines & Dumont, 1984), the Chinese collections have smaller asci (80-105 x 7.5-10 µm vs. 100-150 x 10-15 µm), 7-14(-17)-septate ascospores which are 50-80 x 2.0-2.5 µm, and longer hairs (up to 100 x 5.5 µm vs. 30-55 x 3.5-4.0 µm). *Lachnum calosporum* is the closest species to the Chinese fungus.

Otidea cf. **grandis** (Pers.) Massee, Brit. Fung.-Fl. 4: 446, 1895.

Diagnostic features: Apothecia deeply cupulate, with one side split, sessile, 40 mm in diam.; hymenium beige, receptacle with hyphoid hairs which are less than 100 µm long. Ectal excipulum of textura angularis to textura globulosa, 70-100 µm thick. Medullary excipulum of textura intricata, 250-300 µm thick. Hymenium 270-300 µm thick. Asci 8-spored, 300-350 x 12-16.5 µm. Ascospores ellipsoid, biguttulate, 15.5-19.5 x 9.5-11.5 µm. Paraphyses cylindrical, straight or curved at apex, 3-4 µm wide.

Specimen examined: on the ground, Baihua Mountains, Beijing, alt 1200 m, W.-y. Zhuang & Z. Wang (1224), 1995 IX 19, HMAS 71779.

Notes: The fungus is different from any known species of *Otidea* Fuckel in China (Cao et al., 1990). *Otidea grandis* is the closest species in the genus to the collection from Baihua Mountains (HMAS 71779). It differs from the North American material in ascospores blunt at ends instead of strongly narrowed and somewhat larger (15-19.5 x 9.5-11.5 µm vs. 15-18 x 8 µm), paraphyses much narrower and mostly straight instead of strongly curved (3-4 µm wide vs. 7-8 µm wide), and wider asci (12.5-16.5 µm wide vs. 12-13 µm wide) (Seaver, 1928). We tentatively treat this fungus as *Otidea* cf. *grandis* until more material is found and examined.

Sarcoleotia globosa (Sommerf. : Fr.) Korf, Phytologia 21: 206, 1971.

Diagnostic features: Apothecia capitate, stipitate, head 2-7 x 2-5 mm; hymenium purplish brown to grayish brown, receptacle buff, stipes 15-35 x 0.8-1.0 mm. Ectal excipulum of textura porrecta, 20-50 µm thick. Medullary excipulum of textura intricata, 100-370 µm thick. Subhymenium ca. 25 µm thick. Hymenium 100-130 µm thick. Asci 8-spored, J+, pole walls blue in Melzer's reagent, 102-117.5 x 7.5-12.5 µm. Ascospores elongate-ellipsoid, biseriate, multiguttulate, 20-28 x 3.0-4.8 µm. Paraphyses slightly enlarged and curved at apex, 2.5-4.5 µm wide at apex and 1.5-2.0 µm below.

Specimen examined: on the ground among mosses, Dajing, Jinggang Mountains, Jiangxi Province, W.-y. Zhuang & Z. Wang (1508), 1996 X 23, HMAS 71956.

Notes: One collection from the Jinggang Mountains was made, which agrees with the morphology of *Sarcoleotia globosa* described by Imai (1941), Maas Geesteranus (1966), and Schumacher & Sivertsen (1987).

Scutellinia colensoi Massee ex Le Gal, Bull. Soc. Mycol. Fr. 83: 356, 1967.

Diagnostic features: Apothecia discoid, 2-7 mm in diam; hymenium orange-red, receptacle hairy, brown. Hairs arising from ectal excipulum, rooting, with 2-5 rootlets, 250-1620 x (15-)25-45 µm. Ectal excipulum of textura angularis, 150-300 µm thick. Medullary excipulum of textura intricata, 200-350 µm thick. Subhymenium 30-50 µm thick. Hymenium 200-250 µm thick. Asci 8-spored, J- in Melzer's reagent, 180-230 x 11-15 µm. Ascospores ellipsoid, with irregular warts and crests on surface, (15-) 16-19 x 9.0-12.5 µm; markings somewhat interconnected, up to 2 µm wide and 1 µm high. Paraphyses enlarged at apex, 4.5-9 µm wide at apex and 2.5-4.5 µm wide below.

Specimens examined: on wet rotten wood, Baihua Mountains, Beijing, alt. 1200 m, W.-y. Zhuang, C.-l. Fu, X.-f. Zhu & Z. Wang (1210), 1995 IX 19, HMAS 70348; on wet rotten wood, Baihua Mountains, Beijing, alt. 1200 m, W.-y. Zhuang & Z. Wang (1237, 1239, 1240), 1995 IX 19, HMAS 70347, 70349, 71838.

Notes: It is a common species in the Baihua Mountains. Schumacher (1990) indicated that *Scutellinia colensoi* is a widely distributed fungus. Chinese collections differ from typical material in slightly broad ascospores (16-19 x 9.0-12.5 µm vs. 17.2-20.3 x 9.8-11.6 µm) and smaller asci (180-230 x 11-15 µm vs. 210-280 x 14-19 µm).

PREVIOUSLY REPORTED SPECIES FOR WHICH NEW NAMES ARE REQUIRED

Bisporella clavoflava (Grev.) Lizon & Korf, Mycotaxon 54: 474, 1995.

Korf & Zhuang (1985) reported *Bisporella discendens* (P. Karst.) S. E. Carp. from China. Recently Lizon & Korf (1995) found that *Bisporella clavoflava* is an older name for the fungus.

Boubovia ascoboloides (Korf & W. Y. Zhuang) Y. J. Yao & Spooner, Mycol. Res. 100: 193, 1996.

Yao & Spooner (1996) treated the species previously placed in *Pulvinula* Boud. which have ellipsoid ascospores in a separate genus, *Boubovia* Svrcek. *Pulvinula ascoboloides* Korf & W. Y. Zhuang (1984) was transferred to the latter.

Chlorencoelia versiformis (Pers. : Fr.) Dixon, Mycotaxon 1: 224, 1975.

This is the correct name for the previous Chinese record, *Midotis versiformis* (Pers.) Seav. (Tai, 1979).

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中国盘菌新种和新记录之八

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摘要　本文报道了粒毛盘菌属一新种——庐山粒毛盘菌*Lachnum lushanense*，小舌菌属一个未定名种*Microglossum* sp.，以及十个中国新记录种，包括绿散胞盘菌属*Chlorencoelia*、马鞍菌属*Helvella*、地杯菌属*Geopyxis*、小盖盘菌属*Heyderia*、膜盘菌属*Hymenoscyphus*、粒毛盘菌属*Lachnum*、侧盘菌属*Otidea*、肉锤菌属*Sarcoleotia*和盾盘菌属*Scutellinia*的成员。

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NOTES ON DISCOMYCETES FROM QINGHAI, CHINA *

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ABSTRACT Discomycete specimens from Qinghai Province collected recently and on deposit in the Mycological Herbarium, Institute of Microbiology, Chinese Academy of Sciences (HMAS) were carefully examined. 34 species belonging to 17 genera have been found in that area. Among them, *Cheilymenia* cf. *fimicola, Helvella confusa,* and *Peziza* cf. *phyllogena* are new records for China and *Sowerbyella radiculata* is found for the first time from the mainland of China. Taxonomic and nomenclatural notes were provided where necessary.

Qinghai Plateau is located in the west of China. Relatively few fungi have been collected and reported from that area. Previous discomycete records were summarized in *Fungi of China* by S. C. Teng (1963) based mainly on specimens made in July through September of 1958 and 1959. A recent field trip to Qinghai was organized in August of 1996. Discomycetes were found in the northeastern regions of the province including Qilian, Menyuan, Datong, Ledu, Wulan, Minhe, Dulan, and Huangcheng at altitudes between 2400-3900m. Although available material is very limited, 34 species of 17 genera belonging to the Dermateaceae, Geoglossaceae, Helvellaceae, Leotiaceae, Morchellaceae, Otideaceae, Pezizaceae, and Sclerotiniaceae are recognized. Three species are new records for China (indicated as "n. r." in this paper).

Bisporella cf. **claroflava** (Grev.) Lizon & Korf, Mycotaxon 54: 474, 1995.

Specimen examined: on wood, Minhe, Qinghai, alt. 2600m, Q.-m. Ma & J.-c. Xing 1802, 9 IX 1959, HMAS 23714.

Notes: The apothecia of this fungus are gregarious, confluent, and 0.7-1.7 um in diam when dry. Excipular structure is very similar to that of *Bisporella* Sacc. (Korf & Carpenter, 1974). The asci are 77-87 x 5.5-6.5 µm and ascospores 8-10 x 2.2-3.0 µm. It differs from typical material in asci J+ in Melzer's reagent and longer, most ascospores non-septate instead of one-septate and wider, and *Cystodendron* Bubak anamorph not associated with the apothecia (Carpenter, 1975; Lizon & Korf, 1995).

Calycina herbarum (Pers. : Fr.) Gray, Nat. Arr. Brit. Pl. 1: 669, 1821.

Specimen examined: on herbaceous stems, Ledu, Qinghai, 2600m, J.-c. Xing & Q.-m. Ma 1541, 9 IX 1959, HMAS 31241.

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Cheilymenia cf. **fimicola** (de Not. & Bagl.) Dennis, Brit. Ascom. p. 45, 1978. (**n. r.**)

Specimen examined: on cow dung in *Picea* forest, Qilian, Qinghai, alt. 3050m, Q.-m. Ma 427, 30 VII 1958, HMAS 24244.

Notes: This collection differs from *Tricharina* Eckblad in hairs not in fascicles but solitary and very prominent (Yang & Korf, 1985), from *Pseudombrophila* Boud. in hairs seta-like instead of hyphoid (Brummenlen, 1995), and from typical *Cheilymenia fimicola* in hairs not rooting and with fewer septa, ascospores larger and without mucilaginous coatings (Dennis, 1978; Moravec, 1990).

The hairs of the fungus are seta-like, light brown, with walls 0.5-2.5 µm thick, 1-3-septate, and 150-450 x 15-35 µm. The asci are 188-230 x 15-23 µm. Ascospores occupy almost the entire ascus and are 21.5-24.0 x 11.5-13.5 µm and with refractive, yellowish contents. The fungus is recorded for the first time from China.

Cudonia helvelloides S. Ito & S. Imai, Trans. Sapporo Nat. Hist. Soc. 13: 183, 1934.

Specimen examined: on the ground in conifer forest, Datong, Qinghai, X.-l. Mao, H.-a. Wen & S.-x. Sun 9295, 13 VIII 1996, HMAS 91962.

Notes: The spore size and shape are critical in distinguishing species of *Cudonia* Fr. (Imai, 1941; Mains, 1956). Ascospores of the Chinese collection are aciculate and 46-58 x 1.8-2.0 µm.

Cudonia lutea (Peck) Sacc., Atti Real. Inst. Venet. 6: 725, 1885.

Specimens examined: on the ground in *Picea* forest, Huangchen, Qinghai, alt. 3100 m, Q.-m. Ma 929, HMAS 23871; on the ground, Qilian, Qinghai, alt. 3650m, Q.-m. Ma 482, 13 VIII 1958, HMAS 24094.

Geopora arenicola (Lév.) Kers, Svensk Bot. Tidskr. 68: 345, 1974.

Specimen examined: on the ground, Qilian, Qinghai, alt. 2800m, Q.-m. Ma 586, 21 VIII 1958, HMAS 30570.

Geopora perprolata B. C. Zhang, Acta Mycol. Sin. 11: 12, 1992.

Specimen examined: on the ground, Qilian, Qinghai, alt. 2800m, Q.-m. Ma 583, 21 VIII 1958, HMAS 30569.

Notes: The fungus should be placed in *Geopora perprolata* since its ascospore length / width ratio is 1.75-2.0 and shape is ellipsoid with more or less pointed ends instead of blunt. The original authors did not cite HMAS 30569 when *G. perprolata* was proposed (Zhang & Yu, 1992).

Geopyxis majalis (Fr.) Sacc., Syll. Fung. 8: 72, 1889.

Specimens examined: on the ground, Qilian, Qinghai, alt. 2860m, Q.-m. Ma 532, 18 VIII 1958, HMAS 23709; on mossy soil, Datong, Qinghai, X.-l. Mao, H.-a. Wen & S.-x. Sun 9235, 13 VIII 1996, HMAS 91963.

Notes: This species was recently recorded by Zhuang & Wang (1998) from Baihua Mountains, Beijing at altitude of 1200m. Other known distributions include Sweden (type locality) and Australia (Rifai, 1968).

Helvella acetabula (L.) Quél., Ench. Fung. p. 275, 1886.

Specimen examined: on the ground, Dulan, Qinghai, alt. 3900m, J.-c. Xing & Q.-m. Ma 1316a, 7 VIII 1959, HMAS 71948 (ex HMAS 27727).

Helvella cf. **atra** Holmskj., Beata Fung. Dan. Imp. 2: 47, 1799.

Specimen examined: on the ground, Qilian, Qinghai, alt. 3610m, Q.-m. Ma 480, 11 VIII 1958, HMAS 33627.

Notes: The morphology of the fungus is very similar to *H. atra* but has wider ascospores than typical (18-20.5 x 11.5-14.0 µm vs. 17-17.7-19 x 9.8-10.3-11.0 µm according to Dissing, 1966).

Helvella confusa Harmaja, Karstenia 17: 43, 1977. (**n. r.**)

Specimens examined: on the ground, Dulan, Qinghai, alt. 3900m, J.-c. Xing & Q.-m. Ma 1316, HMAS 27727; on the ground in *Picea* forest, Xiangride, Qinghai, alt. 3800 m, J.-c. Xing & Q.-m. Ma 1446, 8 VIII 1959, HMAS 27728.

Notes: The fungus has identical morphology to *H. solitaria* (Karst.) Karst. *sensu* Dissing (1966). According to Harmaja (1977) *H. confusa* is the correct name.

Helvella crispa (Scop. : Fr.) Fr., Syst. Mycol. 2: 14, 1822.

Specimens examined: on the ground Qilian, Qinghai, Q.-m. Ma, 21 VIII 1958, HMAS 23742; on the ground, Ledu, Qinghai, Q.-m. Ma, 9 IX 1959, HMAS 27679.

Helvella elastica Bull., Herb. France 6: 242, 1785.

Specimens examined: on the ground, Qilian, Qinghai, Q.-m. Ma, 21 VIII 1958, HMAS 23893; on the ground, Ledu, Qinghai, J.-c. Xing & Q.-m. Ma, 9 IX 1959, HMAS 27860.

Helvella leucomelaena (Pers.) Nannf., Fungi Exsic. Suec. Upsal. Fasc. 19-20: 21, No. 952, 1941.

Specimen examined: on duff in conifer forest, Wulan, Qinghai, alt. 3800m, J.-c. Xing & Q.-m. Ma 1250, 27 VII 1959, HMAS 27627.

Humaria hemisphaerica (Wiggers : Fr.) Fuckel, Jahrb. Nass. Vereins Naturk. 23-24: 322, 1870.

Specimen examined: on the ground in broadleaf forest, Qilian, Qinghai, 2800m, Q.-m. Ma 591, 21 VIII 1958, HMAS 24012.

Notes: The ascospores are 21.5-27.5 x 11.5-13.5 µm and with fine warts on surface, which are very similar to collections from the Switzerland (Breitenbach & Kranzlin, 1984).

Hymenoscyphus caudatus (P. Karst.) Dennis, Persoonia 3: 76, 1964.

Specimen examined: on herbaceous stems, Ledu, Qinghai, 2600m, J.-c. Xing & Q.-m. Ma 1541a, 9 IX 1959, HMAS 71949 (ex HMAS 31241).

Microglossum fumosum (Peck) E. J. Durand, Ann. Mycol. 6: 408, 1908.

Notes: This species was recorded by Teng (1963) from Qinghai.

Morchella angusticeps Peck, Ann. Rept. N. Y. State Mus. 32: 44, 1880.

Specimen examined: on the ground, Wulan, Qinghai, J.-c. Xing & Q.-m. Ma, 29 VII 1959, HMAS 27714.

Morchella esculenta (L.) Pers., Syn. Meth. Fung. p. 618, 1801.
Specimen examined: on the ground, Wulan, Qinghai, Q.-m. Ma & J.-c. Xing, 29 VII 1959, HMAS 27718.

Nothomitra sinesis W. Y. Zhuang, Mycotaxon 63: 308, 1997.
Specimen examined: on the ground, Qilian, Qinghai, Q.-m. Ma 338, 29 VII 1958, HMAS 32694.

Ocellaria ocellata (Pers.) Schroet., Krypt.- Fl. Schles 3(2): 150, 1893.
Specimen examined: on bark, Qilian, Qinghai, alt. 2800m, Q.-m. Ma 521, 18 VIII 1958, HMAS 33643.

Notes: *Pezicula ocellata* (Pers.) Seaver was recorded previously (Teng, 1963; Tai, 1979). *Ocellaria* (Tul. & C. Tul.) P. Karst. is the generic name commonly accepted (Korf, 1973; Dennis, 1978; Breitenbach & Kranzlin, 1984). The Chinese material has wider asci (127-140 x 24-33 µm) and longer ascospores (27-40 x 10.0-14.5 µm) than the European collections.

Peziza badia Pers., Obs. Mycol. 2: 78, 1799.
Specimen examined: on the ground, Qilian, Qinghai, Q.-m. Ma, 18 VIII 1958, HMAS 33845.

Peziza brunneoatra Desm., Ann. Sci. Nat. Bot., ser. II, 6: 244, 1836.
Specimens examined: on the ground in broadleaf forest, Qilian, Qinghai, J.-c. Xing & Q.-m. Ma, 21 VIII 1958, HMAS 27729; on the ground Ledu, Qinghai, J.-c. Xing & Q.-m. Ma, 9 IX 1959, HMAS 30804.

Peziza cerea Bull., Herb. Fr. tab. 44, 1780.
Specimen examined: on the ground, Qilian, Qinghai, alt. 3000m, Q.-m. Ma 410, 3 VIII 1958, HMAS 33807.

Peziza cf. **phyllogena** Cooke, Mycographia 1: 148, 1877. **(n. r.)**
Specimen examined: on the ground, Huangcheng, Qinghai, Q.-m. Ma, 9 IX 1958, HMAS 23950.

Peziza cf. **saccardiana** Cooke, Mycographia 1: 174, 1877.
Specimen examined: on the ground, Qilian, Qinghai, Q.-m. Ma, 21 VIII 1958, HMAS 27729.

Sarcosphaera coronaria (Jacq.) Schroet., Krypt.- Fl. Schles 3(2): 49, 1893.
Specimens examined: on sandy soil under Picea, Qilian, Qinghai, alt. 2880m, Q.-m. Ma 319, 27 VII 1958, HMAS 24007; on the ground, Qilian, Qinghai, Q.-m. Ma, 30 VII 1958, HMAS 24111.

Sclerotinia sclerotiorum (Lib.) de Bary, Vergl. Morph. Biol. Pilze, Mycet. Bact. p. 22, 1884.
Specimens examined: on grass land, Qilian, Qinghai, X.-l. Mao, H.-a. Wen & S.-x. Sun 9308, 1 VIII 1996, HMAS 91964; on grass land, Qilian, Qinghai, X.-l. Mao, H.-a.

Wen & S.-x. Sun, 1 VIII 1996, HMAS 91965; on grass land, Qilian, Qinghai, alt. 3100m, Y.-l. Guo Q012, 1 VIII 1996, HMAS 91966.

Scutellinia kerguelensis (Berk.) Kuntze, Rev. Gen. Pl. 2: 869, 1891.

Specimen examined: on rotten wood, Ledu, Qinghai, alt. 3000m, J.-c. Xing & Q.-m. Ma 1616, 11 IX 1959, HMAS 27756.

Notes: Schumacher (1990) provided a world monographic treatment on *Scutellinia* (Cooke) Lamb. HMAS 27756 has characteristics of *S. kerguelensis*.

Scutellinia scutellata (L. : Fr.) Lamb., Fl. Mycol. Belge, Suppl. 1: 299, 1887.

Specimen examined: on bark, Datong, Qinghai, alt. 2400m, Y.-l. Guo Q067, 13 VIII 1996, HMAS 91967.

Scutellinia subhirtella Svrček, Česká Mykol. 25: 85, 1971.

Specimens examined: on soil with duff, Qilian, Qinghai, alt. 3050m, Q.-m. Ma 619, 22 VIII 1958, HMAS 30782; on soil, Menyuan, Qinghai, alt. 2700m, Y.-l. Guo Q055, 5 VIII 1996, HMAS 91968; on duff, Datong, Qinghai, alt. 2800m, J.-y. Zhuang 5685, 14 VIII 1996, HMAS 91961.

Sowerbyella fagicola J. Moravec, Česká Mykol. 27(2): 66, 1973.

Specimen examined: on the ground under *Populus*, Qilian, Qinghai, X.-l. Mao, H.-a. Wen & S.-x. Sun 9307, 13 VIII 1996, HMAS 91958.

Sowerbyella radiculata (Sow.) Nannf., Svensk Bot. Tridsk. 32: 118, 1938.

Specimen examined: on the ground, Qilian, Qinghai, X.-l. Mao, H.-a. Wen & S.-x. Sun 9294, 13 VIII 1996, HMAS 91957.

Notes: This is the first time that the fungus is recorded in the mainland of China.

Sowerbyella rhenana (Fuckel) J. Moravec, Mycol. Helvet. 2: 96, 1986.

Specimens examined: on duff, Datong, Qinghai, X.-l. Mao, H.-a. Wen & S.-x. Sun 9249, 13 VIII 1996, HMAS 91959; on mossy soil, Datong, Qinghai, X.-l. Mao, H.-a. Wen & S.-x. Sun 9302, 13 VIII 1996, HMAS 91960; on the ground, Datong, Qinghai, alt. 2800m, J.-y. Zhuang 5684, 14 VIII 1996, HMAS 91970.

Notes: According to Moravec (1986), the correct genus for the species is *Sowerbyella* Nannf. The former Chinese record was *Aleuria rhenana* Fuckel (Korf & Zhuang, 1985).

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摘要　在对馆藏和近期采集的青海盘菌进行研究的基础上，本文列出青海东北部地区海拔2400-3900米范围内的34种盘菌，它们隶属于8科17属，其中（参照）粪生缘刺盘菌 *Cheilymenia* cf. *fimicola*、混乱马鞍菌 *Helvella confusa* 和（参照）叶盘菌 *Peziza* cf. *phyllogena* 为我国新记录种，根索氏盘菌 *Sowerbyella radiculata* 首次在我国大陆发现。

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TAXONOMIE MOLECULAIRE DES APHYLLOPHORALES

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RESUME

L'étude comparée des ITS (ITS1-5,8S-ITS2) de 360 Basidiomycètes, pour la plupart Aphyllophorales, a permis des remarques au niveau des ordres et des familles. Les espèces porées sont réparties dans quatre branches de l'arbre phylogénétique; les hydnés sont aussi de nature polyphylétique. Bien des ordres sont amendés et cinq ordres nouveaux sont proposés : Péniophorales, Phlébiales, Podoscyphales, Tramétales et Vuilleminiales, ainsi que cinq familles nouvelles : *Acanthophysiaceae*, *Amylostereaceae*, *Gloiotheleaceae*, *Lophariaceae* et *Trametaceae*. Trois combinaisons nouvelles ont été proposées: *Scytinostroma insolitum* (Boid. & Lanq.)n.c., *Thanatephorus microsclerotius* (Weber)n.c. et *Vararia intexta* (Boid. & Lanq.)n.c. L'importance dominante de certains caractères est mis en évidence : par exemple, en tout premier lieu les fibres dextrinoïdes des Lachnocladiales; vient ensuite l'amyloïdie des spores, et plus loin leur ornementation. Les découpages en sous-genres des *Peniophora* ou en sections des *Hymenochaete* ne sont pas confirmés. Par contre la distinction de groupes d'anastomose et de sous-groupes intraspécifiques chez les Cératobasidiales est tout à fait valide; *Rhizoctonia solani* a été rapporté à quatre espèces: *Thanatephorus cucumeris* (Frank)Donk, *Thanatephorus praticola* (Kotila)Flentje, *Thanatephorus sasakii* (Shirai)Tu & Kimbr. et *Thanatephorus microsclerotius* (Weber)n.c. Au niveau spécifique on peut remarquer que dans un genre donné, le nombre de mutations est

plus faible entre espèces partiellement intercompatibles qu'entre espèces interstériles. Lorsque ce nombre est faible (moins de 5?), on pourrait synonymiser. Enfin un très gros intérêt de ce type d'étude phylogénétique est l'identification des anamorphes (exemples des *Rhizoctonia*) ou des myceliums (exemples des mycéliums isolés de bambous par Zhang *et al.*)

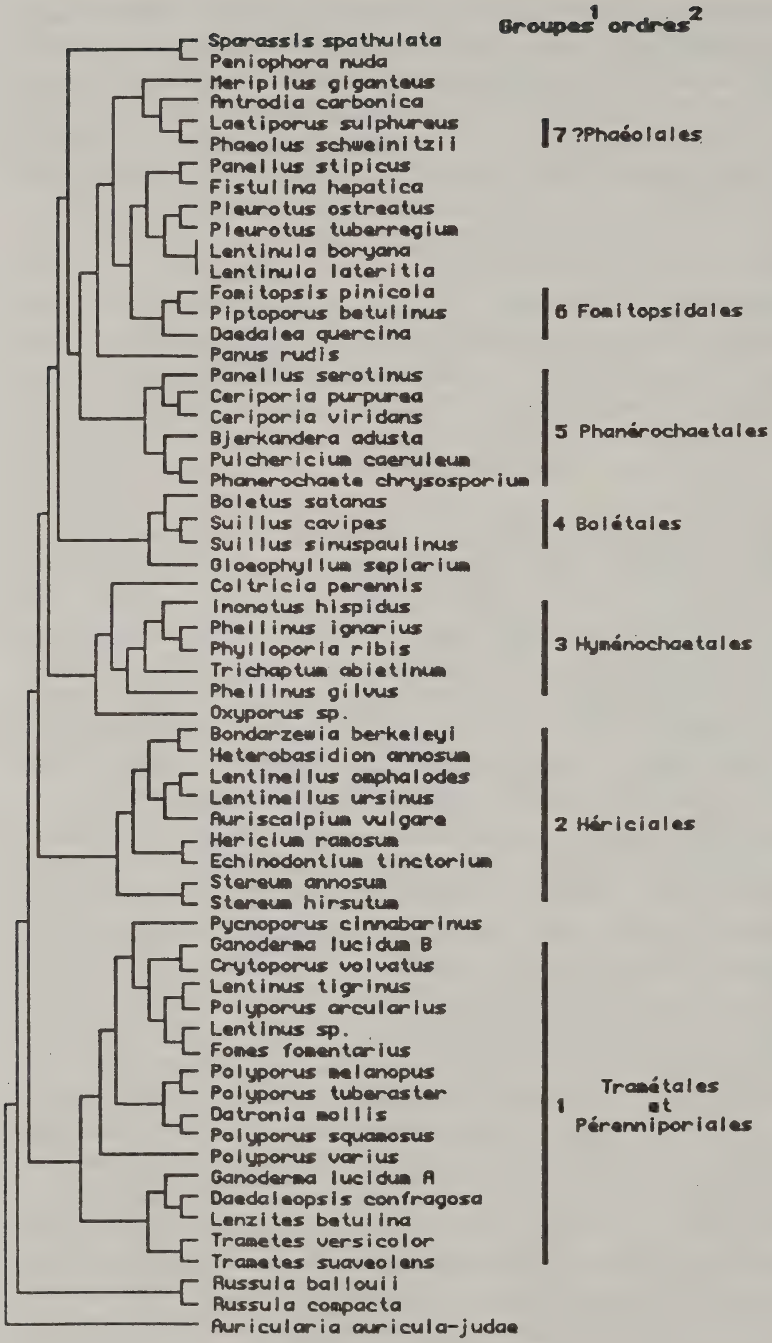
ABSTRACT

Ribosomal internal transcribed spacers (ITS1-5.8S-ITS2) sequences were used to evaluate the phylogenetic relationships within the Aphyllophorales. The results indicate that the Aphyllophorales represent different independent lineages. In some cases phylogenetics support traditional taxonomic groups, e.g. Hericiales with amyloid spores. In other cases, among "polypores", "corticioids", or "hydnaceous" forms, sequence data suggest new, unfamiliar groupings that require revision of the classification. Phylogenetic analysis of ITS sequence data gives insights into the branching structure in the tree; we have considered branchs - as independent evolutionary lineages - which merit formal taxonomic status, e.g. order. About twenty orders have been distinguished; five are proposed as new: Peniophorales, Phlebiales, Podoscyphales, Trametales, and Vuilleminiales, like that five new families: *Acanthophysiaceae*, *Amylostereaceae*, *Gloiotheleaceae*, *Lophariaceae* and *Trametaceae*. Three new combinations have been also proposed: *Scytinostroma insolitum* (Boid. & Lanq.)n.c., *Thanatephorus microsclerotius* (Weber)n.c. and *Vararia intexta* (Boid. & Lanq.)n.c. The Lachnocladiales appear as a monophyletic group with a high bootstrap support; this implies that the diagnostic dextrinoid binding hyphae character is valid. In contrast, molecular data do not provide strong support for subgeneric discrimination in the *Peniophora* or sections in the *Hymenochaete*. The phylogenetic situation is too unstable to formalize now Gloeophyllales and Phaeolales. The work of Hibbett & Donoghue (1995) based on ribosomal small subunit serves as the basis for the discussion. With a combination of evidence from ITS sequence data available through GenBank and from intraspecific groups, we have divided *Rhizoctonia solani* (anamorphic Ceratobasidiales) into four species: *Thanatephorus cucumeris* (Frank)Donk, *Thanatephorus praticola* (Kotila)Flentje, *Thanatephorus sasakii* (Shirai)Tu & Kimbr. and

Thanatephorus microsclerotius (Weber)c.v. ITS regions have rates of substitution that are useful for evaluating the species level relationships. For example, the ITS data indicated a near contempory divergence of Central America *Amylostereum ferreum* and its two closest european relatives. There is little significant divergence within *Peniophora quercina* and *simulans*, less than 2 bases per ITS; considering the conditions used here, the intraspecific diversity might be a PCR artefact. Here we estimated the substitution rate variation among species with different incompatibility systems. Sequences also revealed information about the relationships among mycelia lacking basidiocarps; examples are given with unidentified aphyllophorean fungi isolated from bamboos by Zhang *et al.*

INTRODUCTION

Ces dernières années, l'étude des séquences nucléotidiques a fait l'objet de publications de plus en plus nombreuses. Elles ont porté sur des parties diverses du génome, et sur des champignons très variés. Ceci a permis des avances en systématique, tout d'abord au niveau des classes (par exemple, chez les Basidiomycètes, Walker & Doolittle 1982, Illingworth *et al.* 1991, Bowman *et al.* 1992, Stickwell *et al.* 1992, Swann & Taylor, 1993, 1995, Berres *et al.* 1995, Bresinsky 1996, Liu *et al.* 1997). Certains travaux se sont axés sur l'évolution au cours des temps géologiques en utilisant des secteurs relativement stables, comme la petite sous-unité 18S de l'ARN ribosomique (Berbee et Taylor 1993). A l'inverse, les sections à évolution plus rapide, comme les espaceurs internes transcrits (ITS) notamment, sont de plus en plus utilisés pour détecter les parentés, soit au niveau des ordres, familles et des genres (Hibbett & Donoghue 1995 cf Fig. 1, Moncalvo *et al.* 1995ab, Hallenberg *et al.* 1996, Nakasone 1996) soit au niveau spécifique (Kasuga *et al.* 1993, Nakasone et Sytsma 1993, Adams et Knopp 1996), ou encore pour le rattachement des anamorphes, les *Rhizoctonia* par exemple, aux formes parfaites (Gonzales 1991 cf Fig. 18, Vilgalys & Cubeta 1994, Boysen *et al.* 1996, Mazzola *et al.* 1996). Dans ce travail, près de 360 séquences d'ITS d'espèces de Basidiomycotina Aphyllophorales ont été comparées, et permettront des remarques au niveau des ordres et familles, puis au niveau générique, au niveau spécifique, enfin au niveau infraspécifique chez *Rhizoctonia solani.*


Groupes[1] ordres[2]
Sparassis spathulata
Peniophora nuda
Meripilus giganteus
Antrodia carbonica
Laetiporus sulphureus
Phaeolus schweinitzii
7 ?Phaéolales
Panellus stipicus
Fistulina hepatica
Pleurotus ostreatus
Pleurotus tuberregium
Lentinula boryana
Lentinula lateritia
Fomitopsis pinicola
Piptoporus betulinus
Daedalea quercina
6 Fomitopsidales
Panus rudis
Panellus serotinus
Ceriporia purpurea
Ceriporia viridans
Bjerkandera adusta
Pulchericium caeruleum
Phanerochaete chrysosporium
5 Phanérochaetales
Boletus satanas
Suillus cavipes
Suillus sinuspaulinus
Gloeophyllum sepiarium
4 Bolétales
Coltricia perennis
Inonotus hispidus
Phellinus ignarius
Phylloporia ribis
Trichaptum abietinum
Phellinus gilvus
3 Hyménochaetales
Oxyporus sp.
Bondarzewia berkeleyi
Heterobasidion annosum
Lentinellus omphalodes
Lentinellus ursinus
Auriscalpium vulgare
Hericium ramosum
Echinodontium tinctorium
Stereum annosum
Stereum hirsutum
2 Hériciales
Pycnoporus cinnabarinus
Ganoderma lucidum B
Crytoporus volvatus
Lentinus tigrinus
Polyporus arcularius
Lentinus sp.
Fomes fomentarius
Polyporus melanopus
Polyporus tuberaster
Datronia mollis
Polyporus squamosus
Polyporus varius
Ganoderma lucidum A
Daedaleopsis confragosa
Lenzites betulina
Trametes versicolor
Trametes suaveolens
1 Tramétales et Péronniporiales
Russula ballouii
Russula compacta
Auricularia auricula-judae

MATERIEL ET METHODES

1. Liste des espèces étudiées excepté les Cératobasidiales

Les exsiccata correspondants conservés à l'Université de Lyon I sont précédés des lettres LY, herbier J. Boidin, ou D, herbier A. David. Les cultures CBS proviennent du Centraalbureau voor Schimmelcultures (Baarn Hollande)

Acanthophysium bisporum Boid. & Lanq., LY 7664, holotype, Guadeloupe 8-1975
Acanthophysium buxicola Boid. & Lanq., LY 7721, holotype, sur *Buxus*, Vaucluse, 5-1977
Acanthophysium norvegicum (Erikss. & Ryv.)Boid. *et al.*, LY 10622, sur *Rubus*, Ain, 10-1984
Acanthobasidium phragmitis Boid. *et al.*, LY 10309, sur *Sasa japonica*, Pyrénées atlantiques, 2-1984
Acanthophysium ahmadii (Boid.)Boid., LY 2063, Pakistan, 9-1955
Acanthophysium thoenii Boid., Lanq. & Gilles, LY6941, sur bambou, Zaïre, 7-1972
Aleurobotrys botryosus (Burt)Boid. *et al.* , Katanga, 8-1971
Aleurocystidiellum subcruentatum (Berk.& Curt.)Lemke, sur *Picea jezoensis*, URSS, 8-1951
Aleurodiscus amorphus (Pers.:Purt)Schroet., LY 4559, sur *Abies amabilis*, British Columbia (Canada), 9-1963
Aleurodiscus aurantius (Fr.) Schroet., CBS 104.54
Aleurodiscus gabonicus Boid., Lanq. & Gilles, LY 9141, holotype, Gabon, 1-1979
Aleurodiscus mirabilis (Berk.& Curt.)Höhn., LY 9585, Madagascar, 6-1980
Aleurodiscus wakefieldiae Boid. & Beller, LY 4556, Pyr. atlant., 10-1963
Amauromyces farinaceus Boid. Lanq. & Gilles, LY 14195, holotype, sur *Cryptomeria*, Réunion, 3-1990
Amphinema byssoides (Pers.:Fr.)Erikss., LY 243, Rhône, 3-1949
Amyloathelia amylacea (Bourd. & Galz.)Hjortst. & Ryv., LY 8322, *Picea*, Italie, 7-1977, et LY 16443, *Juniperus*, Pyrénées orient., 10-1995
Amylostereum areolatum (Fr.) Boid., sur *Picea abies*, Allemagne, 11-1978
Amylostereum ferreum (Berk. & Curt.)Boid. & Lanq., sur *Podocarpus lambertii*, Brésil, 10-1978

Figure 1. Arbre phylogénétique des *Polyporaceae* (redessiné d'après Hibbett & Donoghue 1995, basé sur la comparaison des séquences de la petite sous-unité 18S de l'ADN ribosomique montant une certaine correspondance entre les groupes (1) d'Hibbett & Donoghue et les ordres (2) présentés dans cette étude, basés sur les ITS. Notez, la position des *Stereum* et des *Russula* - assez inexplicable chez Hibbett & Donoghue - a été intervertie ici.

Amylostereum laevigatum (Fr.)Boid., LY 8927, sur *Juniperus communis*, Vaucluse, 10-1978
Antrodia albida (Fr.:Fr.)Donk, D 138
Antrodia gossypina (Speg.)Ryv., D 4785, Var, 12-1986
Antrodia malicola (Berk. & Curt.)Donk, D363, *Pinus*, Vaucluse, 12-1966
Antrodia serialis (Fr.)Donk, D 439, sur *Picea*, Ain, 8-1967
Antrodia vaillantii (Fr.)Ryv., D 3653, Centre Technique du Bois, Paris
Antrodia xantha (Fr.:Fr.)Ryv., D 4406, sur *Larix*, Suisse, 6-1982
Antrodiella hoehnelii (Bres.:Höhn.)Niem., D 4690, *Fagus*, Ain, 9-1986
Antrodiella semisupina (Bert. & Curt.)Ryv., D 812
Athelia decipiens (Höhn. & Litsch.) Erikss., LY 7321, Ain, 3-1974
Athelia epiphylla Pers.:Fr., voir réf. Adams & Kropp, 1996
Athelia arachnoidea (Berk.)Jül., voir réf. Adams & Kropp, 1996
Auricularia auricula-judae (Fr.) Schroet. LY 4221, *Sambucus* , Ain, 3-196
Auriscalpium vulgare S.F. Gray, CBS 190.47
Bjerkandera fumosa (Pers.:Fr.)Karst., D 3634
Bjerkandera imberbis (Bull.:Mérat), D 249
Boidinia subsperispora (Litsch.)Jül., LY 10333, sur *Pinus*, Landes, 2-1984
Boreostereum radiatum (Peck)Parm., LY 9939, sur *Salix*, Sibérie, 8-1981
Botryobasidium candidans J. Erikss., LY 3799, sur *Betula*, Ain, 9-1960
Botryobasidium sphaericosporum Boid. Cand. & Lanq., LY 9985, sur *Quercus*, Landes, 6-1982
Botryobasidium subcoronatum (Höhn. & Litsch.)Donk, LY 10162, sur *Picea*, Savoie, 8-1983
Bourdotia galzinii (Bres.)Trott. *ap.* Sacc., Isère, 4-1963
Candolabrochaete septocystidia (Burt)Burds., LY 14509, sur *Quercus*, Pyrénées atlantiques, 6-1990
Ceraceomerulius serpens (Fr.)Erikss. & Ryv., sur *Picea*, Autriche, 9-1982
Ceriporia rhodella Fr.:Fr., D 504, sur *Fagus* , Pyrénées atlant., 10-1967
Ceriporia viridans (Berk. & Br.)Donk, D 3069, sur *Prunus*, Rhône, 11-1972
Ceriporiopsis gilvescens (Bres.)Dom., D 386, sur *Fagus* Var, 2-1967
Ceriporiopsis pannocincta (Rom.)Gilb. & Ryv., D 814
Clavaria abietina Pers.:Fr., CBS 12363
Clavulicium macounii (Burt)Erikss. & Boid., Suisse, 8-1993
Climacodon pulcherrimus (Berk. & Curt.)Nikol., sur *Pinus*, Var, 11-1966
Columnocystis abietina (Pers.:Fr.)Pouz., LY 4881, sur *Abies*, Alpes maritimes, 11-1964
Conferticium ochraceum (Fr.:Fr.)Hallenb., LY 4920, sur *Picea*, Alpes maritimes, 9 : 1964
Corticium meridio-roseum Boid. & Lanq., LY 4715, holotype, sur *Amygdalus*, Var, 4-1964
Corticium roseum Pers., LY 9975, sur *Salix*, Ain, 5-1982
Cotylidia diaphana (Schw.)Lentz, LY 7256, Guyane, 1-1974
Crustoderma dryinum (Berk. & Curt.)Parm., sur *Pinus* , Var, 4-1964
Cylindrobasidium evolvens (Fr.:Fr.)Jül., LY 4432, 7-1995
Cymatoderma dendriticum (Pers.)Reid, LY 5433, sur *Calamus*, Rép. Centrafricaine, 5-1965
Cymatoderma elegans Jungh., LY 6350, Gabon, 10-1968
Cystostereum murraii (Berk. & Curt.)Pouz., LY 3899, sur *Betula*, 10- 1960
Dendrocorticium durangense (Larss. & Gilb.), culture Pr. Lombard, USA

Dendrocorticium roseo-carneum (Schw.)Larss. & Gilbert., LY 4326, sur *Corylus manshurica*, Sibérie, 9-1961

Dentipellis fragilis (Pers.:Fr.)Donk, LY 10213, Pyrénées atlant., 8-1983

Dentipellis leptodon (Mont.)MaasGeest., LY 5924, Rép. Centrafric., 9-1967

Dentipratulum bialovisiense Domanski, LY 15613, Suisse, 8-1983

Dichostereum durum (Bourd. & Galz.)Pilat, LY 9450, Yvelines, 7-1979

Dichostereum effuscatum (Cooke & Ell.)Boid. & Lanq., LY 6697, sur *Salix*, Vendée, 11-1971

Dichostereum pallescens (Schw.)Boid. & Lanq., LY 6784, Canada

Dichostereum rhodosporum (Wakef.)Boid. & Lanq., LY 6851, culture de Warcup T433, Australie

Duportella halimi (Boid. & Lanq.)Hjortst., sur *Atriplex halimus*, Loire atlantique, 8-1972

Duportella kuehneroides Boid., Lanq. & Gilles, LY 14314, Réunion, 3-1990

Duportella malençonii (Boid. & Lanq.)Hjortst., LY 16444, sur *Spartium*, Pyrénées orientales, 10-1995

Duportella miranda Boid., Lanq. & Gilles, LY 13702, Nouvelle Zélande

Duportella tristicula (Berk. & Br.)Pat., LY 12653, sur *Acacia farnesiana*, Réunion, 3-1987

Echinodontium tinctorium (Ell. & Ev.)Ell. & Ev., CBS 162.29

Efibula pallido-virens (Bourd. & Galz.)Wu, LY 16025, sur *Hedera helix*, Haute-Savoie, 10-1994

Eichleriella spinulosa (Berk. & Curt.)Burt, LY 4045, *Alnus*, Savoie, 9-1961

Epithele citrispora Boid., Lanq. & Gilles, LY 7158, Côte d'Ivoire, 4-1973

Epithele malaiensis Boid. & Lanq., LY 8252, holotype, Singapour, 8-1977

Epithele nikau G.H. Cunn., LY 9119, Gabon, 1-1979

Epithele typhae (Pers.)Pat., LY 4157, sur *Carex riparia*, Ain, 11-1961

Erythricium laetum (Karst.)Erikss. & Hjortst., LY 5811, Danemark, 3-1967

Exidia truncata Fr., sur *Quercus robur*, Rhône, 4-1960

Exidiopsis calcea (Pers.)Wells, LY 3946, Maroc, 5-1961

Fibulomyces septentrionalis (Erikss.)Jül., sur *Pinus*, Pyrénées, 10-1995

Fibularhizoctonia centrifuga, voir *Athelia epiphylla*

Flavodon flavus (Kl.) Ryv., LY 5988, sur *Chrysophyllum*, Rép. Centrafric., 9-1967

Flavophlebia sulfureo-isabellina (Litsch.)Larss. & Hjortst., sur *Abies*, Hautes Pyrénées, 5-1963

Fomitopsis officinalis (Vill.:Fr.)Bond. & Sing., D 543, sur *Cedrus*, Maroc, 10-1967

Fomitopsis spraguei (Berk. & Curt.) Gilb. & Ryv., D 3000, sur *Quercus rubra*, Canada, 9-1971

Galzinia occidentalis, voir à *Hyphoderma*

Ganoderma applanatum (Pers.:Pat), CBS 175.30

Ganoderma gibbosum, réf. Moncalvo *et al.* 1995a

Gastrosuillus laricinus, réf. Baura *et al.* 1992

Gloeocystidiellum bisporum Boid., Lanq. & Gilles, LY 15862, holotype, sur *Quercus*, Pyrénées atlantiques, 3-1994

Gloeocystidiellum clavuligerum (Höhn. & Litsch.)Nakas., sur *Corylus*, Pyrénées orientales, 9-1984

Gloeocystidiellum porosellum Hjortst., LY 13408, Pyrénées orient., 5-1988

Gloeocystidiellum porosum (Berk. & Curt.)Donk. LY 16540, sur *Salix atrocinerea*, Landes, 2-1985
Gloeocystidiellum wakullum, voir à *Stereum*
Gloeocystidiopsis flammea (Boid.)Jül., LY 5580, Rép. Centrafric., 5-1965
Gloeodontia discolor (B. & Curt.)Boid. LY 5559, Rép. Centrafric., 5-1965
Gloeophyllum sepiarium (Berk.)Hjortst., D 3952, Japon, 7-1980
Gloeophyllum trabeum (Pers.:Fr.)Murr., CBS 900.73
Gloiodon strigosus (Swartz:Fr.)Karst., Haute-Savoie, 3-1991
Gloiothele lactescens (Berk.)Hjortst., LY16387, sur *Populus* , Ain, 10-1995
Hericium coralloides (Scop.:Fr.)Gray, LY9910, Seine et Marne, 10-1981
Heterobasidion annosum (Fr.)Bref., réf. Kasuga *et al.* 1993
Heterobasidion insulare (Mur.)Ryv., CBS 451.76
Hymenochaete borbonica Lég. & Lanq., LY L518, sur *Cryptomeria japonica*, Réunion, 4-1985
Hymenochaete carpatica Pilat, LY L614, *Acer*, Suisse, 2-1990
Hymenochaete cinnamomea (Pers.) Bres. LY L690, Allier, 11-1990
Hymenochaete cervinoidea Lég. & Lanq., LY L557, Réunion, 3-1987
Hymenochaete coffeana Lég. & Lanq., LY 5482, sur *Coffea robusta*, Rép. Centrafric.aine, 5-1965
Hymenochaete denticulata Lég. & Lanq., LY L674, Réunion, 4-1990
Hymenochaete fuliginosa (Pers.)Lév., LY L587, sur *Abies*, Pyrénées atlantiques, 8-1989
Hymenochaete hauerslevii Lég., LY L649, Réunion, 3-1990
Hymenochaete nanospora Lég., LY 5914, Rép. Centrafric., 9-1967
Hymenochaete pinnatifida Burt, LY L664, Réunion, 4-1990
Hymenochaete pseudo-adusta Lég. & Lanq., LY L611, Thaïlande, 1-1990
Hymenochaete rhabarbarina (Berk.)Cooke, LY L527, sur *Nastus borbonicus*, Réunion, 4-1985
Hymenochaete rheicolor (Mont.)Lév., LY 6374, Guyane, 10-1968
Hymenochaete rubiginosa (Dicks.:Fr.)Lév., LY 2059, Pakistan, 9-1955
Hymenochaete separabilis Lég., LY L523, sur *Raphia* Réunion, 4-1985
Hymenochaete subfuliginosa (Bourd. & Galz.)Hruby, LY L687, Bohème, 7-1990
Hyphoderma mutatum (Peck)Donk, LY 10262, sur *Fagus*, Var, 11-1983
Hyphoderma occidentale (Rogers)Boid. & Gilles, LY 14631, sur *Salix capraea*, Allier, 11-1990
Hyphoderma setigerum (Fr.)Donk, LY 4522, Pyrénées atlantiques, 6-1963
Hyphoderma variolosum Boid., Lanq. & Gilles, LY 9208, Gabon, 3-1979
Hyphodermella corrugata (Fr.)Erikss. & Ryv., LY 4674, sur *Quercus pubescens*, Drôme, 3-1974
Hypochnicium bombycinum (Somm.:Fr.)Erikss., LY 1402, sur *Salix cinerea*, Ain, 10-1953
Hypochnicium cystidiatum Boid., LY 5893, bambou, Rép. Centrafricaine., 9-1967
Hypochnicium erikssonii Hall. & Hjortst., LY 4574, Pyr. atlant., 11-1963
Hyphodontia barba-jovis (Fr.)Erikss., LY 4151, *Populus* , Ain, 10-1961
Inonotus tomentosus (Fr.)Teng., D 809, Pyrénées, 11-1996
Ischnoderma benzoinum (Wahlenb.:Fr.)Karst., D 4252
Ischnoderma resinosum (Fr.)Karst., D 4261
Junghuhnia fimbriatella (Peck.)Ryv., D 4203, Yougoslavie, 10-1981

Laxitextum bicolor (Pers.:Fr.)Lentz, LY 3875, sur *Quercus*, Louisiane, USA, 10-1960 et LY 7434, sur *Corylus*, Haute-Savoie, 8-1974
Lenzites betulinus (L.:Fr.)Fr., CBS 102.11
Lenzites reichardtii Scheilz. *in* Thüm., D 258, sur *Populus*, Drôme, 5-1966
Leptoporus mollis (Pers.:Fr.)Quel., D 522, sur *Pinus* brulé, 5-1966
Leptosporomyces roseus Jülich, LY 567, holotype, Haute-Savoie, 9-1950
Leucogyrophana pinastri (Fr.)Ginns & W., LY 347, Haute-Savoie, 9-1949
Lopharia cinerascens (Schw.)Cunn., LY 5686, Argentine, 4-1966, et CBS 486.62
Lopharia mirabilis (Berk. & Br.)Pat., LY 7399, Singapour, 7-1974
Megalocystidium luridum (Bres.)Jül., LY 10954, sur *Ulex*, Landes, 3-1985
Megalocystidium luteo-cystidiatum (Talbot)Wu, LY 9194, Gabon, 3-1979
Meripilus giganteus (Pers.:Fr.)Karst., D 4357, sur *Quercus*
Meruliopsis corium (Fr.)Ginns, LY 9795, sur *Picea*, Haute-Vienne, 5-1981
Meruliopsis taxicola (Pers.)Bond., sur *Pinus sylvestris*, Gers, 11-1963
Merulius tremellosus Fr., CBS 217.56
Mycoacia nothofagi (G.H. Cunn.)Ryv., LY6552, Gers, 10-1970
Mycoacia nuda (Fr.)Donk, LY 6444, Angleterre, 11-1969
Oligoporus caesius (Schrad.:Fr.)Gilb. & Ryv., CBS 515.85
Oligoporus leucomallellus (Murr.)Gilb. & Ryv., D 3896, sur *Pinus halepensis*, Gard, 2-1980
Oligoporus luteocaesius (David)Ryv. & Gilb., D 3519
Oligoporus rennyii (Berk. & Br.)Donk, D 449, sur conifère très pourri
Oligoporus sericeomollis (Romell)Bondartz., D 897
Oligoporus tephroleucus (Fr.)Gilb. & Ryv., D 4037, *Fagus*, Ain, 10-1980
Oxyporus latemarginatus (Dur. & Mont.)Donk, CBS 298.33
Paullicorticium pearsonii (Bourd.)Erikss., LY 15624, *Picea*, Suisse, 8-1993
Peniophora aurantiaca (Bres.)Höhn. & Litsch., LY 4011, sur *Alnus viridis*, Savoie, 9-1961
Peniophora bonariensis Gomez, LY 7514, sur *Ligustrum lucidum*, Argentine, 12-1974
Peniophora fasticata Boid. & Lanq., LY 14735, Ethiopie, 2-1991
Peniophora guadelupensis Boid. & Lanq., LY 8021, Guadepoupe, 9-1976
Peniophora incarnata (Fr.)Karst., LY 4579, sur *Sarothamnus scoparius*, Ain, 11-1963 et CBS 466.72
Peniophora junipericola Erikss., LY 3870, sur *Juniperus communis*, Drôme, 10-1960
Peniophora laurentii Lund., LY 7354, sur *Salix*, Suède, 6-1974
Peniophora lilacea Bourd. & Galz., LY 4436, sur *Prunus*, Arménie, 9-1962
Peniophora malaiensis Boid., Lanq. & Gilles, LY 8292, sur *Calophyllum ferrugineum*, Singapour, 8-1977
Peniophora meridionalis Boid., LY 1492, holotype, Drôme, 4-1954
Peniophora ovalispora Boid., Lanq. & Gilles, LY 12339, Réunion, 3-1987
Peniophora pilatiana Pouz. & Svrc., LY 9737, sur *Pistacia*, Corse, 4-1981
Peniophora pini (Schleich.:Fr.)Boid., LY 1999, sur *Pinus*, Ardèche, 9-1955
Peniophora pithya (Pers.)Erikss., LY 10004, sur *Abies* , Sibérie, 8-1995
Peniophora quercina (Pers.:Fr.)Cooke, LY 16490, *Quercus*, Ain, 11-1995
Peniophora reidii Boid. & Lanq., LY 8831 holotype, Landes, 7-1978
Peniophora scintillans G.H. Cunn., LY 12415, sur *Senecio ambavilla*, Réunion, 3-1987

Peniophora simulans Reid, LY 5152 holotype,*Fagus* Landes, 7-1978
Peniophora suecica Litsch., LY 13996, sur *Quercus*, Yvelines, 9-1986
Perenniporia fraxinea (Bull.:Fr.)Ryv., D 190, Saône et Loire, 11-1968
Perenniporia medulla-panis (Jacq.:Fr.)Donk, D 4597
Perenniporia ochroleuca (Berk.)Ryv., CBS 387.36
Perenniporia subacida (Peck)Donk, D 4554
Perenniporia tenuis (Schw.:)Ryv., D 4322
Phaeolus schweinitzii (Fr.)Pat., D 1411 et CBS 246.28
Phanerochaete affinis (Burt)Parm., CBS 347.54
Phanerochaete burtii (Romell:Burt)Parm., CBS 297.62
Phanerochaete chrysosporium Burds., voir réf. Jonhston & Aust, 1994, et CBS 246.84
Phanerochaete sordida (Karst.)Erikss. & Ryv., LY 4669, sur *Quercus pubescens*, Drôme, 3-1964
Phanerochaete velutina (DC:Pers.)Karst., LY 10016, sur *Sarothamnus*, Haute-Vienne, 9-1982, et CBS 413.50
Phellinus hartigii (Allesch. & Schnabl.)Bondartz., D 4176
Phellinus igniarius (L.:Fr.)Quél., CBS 220.39
Phellinus pseudo-punctatus David, Deq. & Fiass., D3715
Phellinus salicinus (Pers.:Fr.), D168, sur *Tilia*, Drôme
Phellinus torulosus (Pers.)Bourd. & Galz., D 223
Phlebia centrifuga Karst., LY 13940, sur *Picea*, Savoie, 11-1989
Phlebia chrysocreas (B. & C.)Burds., LY 15497, *Quercus*, Landes, 4-1993
Phlebia queletii, voir à *Steccherinum*
Phlebia radiata Fr., LY 221, Rhône, 12-1948
Phlebia rufa (Fr.)Christ., LY 416, Haute-Savoie, 9-1949
Phlebia serialis (Fr.)Donk. LY 3983, sur *Picea*, Savoie, 9-1961
Phlebia subserialis (Bourd. & Galz.)Donk, LY 4698,sur *Pinus* ,Var, 4-1964
Phlebiopsis roumeguerei (Bres.)Jül. & Stalp., LY 6570, sur *Quercus*, Drôme, 12-1970
Physisporinus rivulosus (Berk. & Curt.)Ryv., D 803
Physisporinus sanguinolentus (Alb. & Schw.:Fr.)Pilat, D 3977
Podoscypha multizonata (Berk. & Br.)Pat., LY 6555, Loire atlant., 11-1970
Podoscypha petalodes (Berk.)Pat. subsp. *rosulata* Reid, LY 4317, Pakistan, 8-1962
Podoscypha venustula (Speg.)Reid, LY 6373, Guyane, 10-1968
Poria placenta Fr., CBS 384.82 et D 309
Porogramme albocincta (Cooke & Massee), D 2208
Ptychogaster rubescens Boud., CBS 425.86
Pulcherricium caeruleum (Lam.:St.Amans)Parm., CBS 899.73
Punctularia ethiopica Boid. *ad interim*, LY 14750, Ethiopie, 2-1991
Repetobasidium erikssonii Oberw., LY 15461, sur *Salix*, Landes, 3-1993
Repetobasidium mirificum Erikss., LY 11918, sur *Pinus*, Landes, 4-1986
Rhizopogon subcaerulescens Fr., réf. Baura *et al.* 1992
Rigidoporus lineatus (Pers.)Ryv., CBS 167.65
Russula drimeia, *fragilis*, *queletii* et *ochroleuca* venus de la Société Linnéenne de Lyon
Sarcodontia setosa (Pers.)Donk, CBS 155.63
Scopuloides leprosa (Bourd. & Galz.)Boid., Lanq. & Gilles, LY 15399, sur *Robinia*, Ain, 1-1993

Scytinostroma africano-galactinum Boid. & Lanq., LY7100, Côte d'Ivoire,12-1972

Scytinostroma decidens Boid., Lanq. & Gilles, LY 9196, holotype, Gabon, 3-1979

Scytinostroma eurasiatico-galactinum Boid. & Lanq., LY 9562, holotype, sur *Populus*, Isère, 3-1980

Scytinostroma intextum Boid., Lanq. & Gilles, var. *magnisporum* Boid., Lanq. & Gilles, LY 8540, sur *Raphia*, Gabon, 1-1978

Scytinostroma microspermum Boid. & Lanq., LY8024, Guadeloupe, 9-1976

Scytinostroma neogalactinum Boid. & Lanq., LY 7290, Guyane, 11-1974

Sistotremella perpusilla Hjortst., LY 13296, sur *Salix*, Landes, 3-1988

Skeletocutis papyracea David, D 4067, sur *Abies*, Croatie, 8-1980

Spongipellis delectans (Peck)Murr., CBS 147.40

Spongipellis pachyodon (Pers.)Kotl. & Pouz., D 1943

Steccherícium rhizoides (non publié), LY 7987, Gabon, 5-1976

Steccherinum bourdotii Saliba & David, LY 6562, *Alnus*, Loire, 11-1970

Steccherinum queletii (Bourd. & Galz.) Hall. & Hjortst., LY 10238, sur *Cedrus*, Vaucluse, 10-1983

Steccherinum ochraceum (Pers.:Fr.)S.F. Gray, LY 3660, sur *Sarothamnus scoparius*, Ardèche, 1-1960

Steccherinum rhois (Schw.)Banker, LY 3467, Haute-Garonne, 9-1969

Stereum reflexulum Reid, LY 8342, sur *Arbutus unedo*, Var, 11, 11-1967

Stereum rugosum (Pers.:Fr.)Fr., LY 3837, *Quercus ilex*, Ardèche, 9-1960

Stereum sanguinolentum (Alb. & Schw.:Fr.)Fr., CBS 927.72

Stereum wakullum (Burds., Nakas. & Freem.)Wu, Mississipi, 11-1981

Suillus spraguei, réf. Baura *et al.* (1992)

Trametes versicolor (L.:Fr.)Pilat, CBS737.85 et 6 isolats Rhône-Alpes, 1996

Trametes pubescens (Schum.:Fr.)Pilat, CBS 396.90

Trametes cervina (Schw.)Bres., D 4235

Tulasnella violea (Quél.)Bourd. & Galz.

Vararia callichroa Boid., Gilles & Lanq., LY 12757, holotype, 4-1987

Vararia cinnamomea Boid.,Lanq. & Gilles, LY9750, holotype, Madagascar, 4-1981

Vararia gomezii Boid. & Lanq., LY 8062, Guadeloupe, 9-1976

Vararia insolita Boid. & Lanq., LY 6812, holotype, Côte d'Ivoire, 5-1972

Vararia investiens (Schw.)Karst., LY 6800, DAOM 31934, Canada

Vararia malaysiana Boid. & Lanq. LY 8308, holotype, Singapour, 8-1977

Vararia sigmatospora Boid., Gilles & Lanq., LY 11207, Réunion, 4-1985

Vararia sphaericospora Gilberts., LY 6216, Gabon, 3-1968

Vararia trinidadensis Welden, LY 9787, Madagascar, 4-1981

Veluticeps heimii Malenç., LY 7453, Hérault, 9-1974

Vuilleminia alni Boid., Lanq. & Gilles, LY 15331, sur *Alnus glutinosus*, Pyrénées atlantiques, 10-1992

Vuilleminia comedens (Nees:Fr.)Maire, LY 15352, sur *Prunus laurocerasus*, Rhône, 11-1992

Vuilleminia coryli Boid., Lanq. & Gilles, LY 13401 holotype, sur *Corylus avellana*, Rhône, 5-1988

Vuilleminia cystidiata Parm., LY 10018, sur *Crataegus*, Autriche, 9-1982

Xylobolus frustulatus (Pers.:Fr.)Boid., sur *Quercus* Arménie, 9-1962

2. Liste des séquences d'ITS des Cératobasidiales

a. *Thanatephorus*

isolats	n° Genbank	réf.
AG1-IA		
A-10	AB000010	1
Cs-Gi	AB000016	1
Cs-Ka	AB000017	1
AG1-IB		
CBS 206.84		5
SHIBA	AB000039	1
SFBV-1	AB000038	1
001-7	AB000025	1
AG1-IC		
CBS 207.84		5
RH-28	AB000035	1
PS-1	AB000029	1
AG1	U19951	1
AG2-1		
P-2	AB000026	1
P-5	AB000027	1
R123	AB000030	1
021R91	U57729	3
021R81	U57728	3
021R61	U57726	3
021R71	U57727	3
021R14	U57723	3
021R41	U57725	3
021R21	U57724	3
021R01	U57722	3
21RF61L	U57730	3
RT13	U64099	3
RT14	U64100	3
AG2-2IIIB		
B60	AB000013	1
22R27	U57739	3
22R25L	U57738	3
22R25	U57737	3
22R23	U57736	3
22R22L	U57735	3
22R22	U57734	3
22R21	U57733	3
22R20	U57732	3
CBS 209.84		5
AG2-2IV		
CBS 210.84		5
RS	U63969	3
BC-10	AB000014	1
AG3		
ST6-3	AB000043	1
ST4-1	AB000042	1
ST3-1	AB000041	1
PKA-9	AB000024	1
OKA-6	AB000023	1
I	AB000001	1
30	AB000002	1
1600	AB000004	1
1614	AB000005	1
CBS 211.84		5

isolats	n° Genbank	réf.
AG4 HG-I		
Chr-3	AB000015	1
78-23R-3	AB00007	1
AH-1	AB000012	1
GM-3	AB000018	1
Pf-10	AB000028	1
R97	AB000031	1
haricot		5
ME84B	U19955	2
ME84A	U19954	2
ME87B	U19957	2
ME82A	U19952	2
ME87A	U19956	2
ME82B	U19953	2
rh13	U19960	2
rh13L	U19961	2
HG4 HG-II		
RSA	U19964	2
PINJRS3	U19959	2
PINJRS1	U19958	2
78-3R-9	AB000008	1
78-4R-26	AB000009	1
77-26R-1	AB000006	1
UHBC	AB000045	1
RR5-2	AB000036	1
Rh-165	AB000033	1
Rh-131	AB000032	1
HG-II	AB000034	1
AG5		
CBS 212.84		5
K31	AB000021	1
23R01	U57743	3
23R03	U57742	3
23R02	U57741	3
23R01	U57740	3
AG6		
HGI HAM1-1	AB000019	1
GV NKN2-1	AB000022	1
CBS 231.84		5
AG7		
CBS 214.84		5
1556	AB000003	1
AG8		
C-1		4
CBS 233.93		5
A68	AB000011	1
AG9		
TX S4R1	AB000037	1
TPV12M	AB000046	1
AGBI		
TE2-4	AB000044	1
CBS 205.84		5
CBS 593.81		5
Vigne		
25.1	*Vitis* 6-1996	5

b. Cératobasidiales, autres que *Thanatephorus*

isolats	GenBank*	réf
Ceratobasidium		
C. anceps (Bres. & Syd)Jacks. LY39		5
RH2815 **	U19962	2
RH2815L **	U19950	2
521 **	U19963	2
CAG-A (CBS 605.81)		5
CAG-D (INRA Dijon)		5
CAG-G (INRA Dijon)		5
ASN-2	AB000040	1
Waitea circinata Warcup & Talbot		
WAG-0 (CBS 475.82)		5
Uthatobasidium		
U. fusisporum (Schroet.)Donk LY16490		5
U. fusisporum CBS 338.52		5

Réf. 1. Kuninaga 1997. 2. Boysen *et al.* 1996. 3. Salazar *et al.* 1997. 4. Mazzola *et al.* 1996. 5. cette étude.
* adresse internet : http://www2.ncbi.nlm.nih.gov
** Les isolats RH2815, RH2815L et 521 ont été classés initiallement par Boysen *et al.* (1996) dans le groupe AG4

Extraction de l'ADN total. Le mycélium est broyé dans un tampon d'extraction CTAB (bromure de méthyl tri-méthyl ammonium) à 2% puis incubé à 65° C pendant 30 minutes. L'élimination des protéines est réalisée par addition d'un mélange chloroforme et d'alcool isoamylique (24:1, v/v); après centrifugation le surnageant est précipité dans de l'isopropanol. Après une nouvelle centrifugation, l'ADN est repris dans un tampon Tris-EDTA.

Les ITS. La région de l'ADN amplifiée, généralement formée de 650 à 700 paires de bases chez les Basidiomycètes, comprend les deux espaceurs internes transcrits (ITS1 et ITS2) et la région 5,8 S (Fig. 2). Buckner *et al.* (1988) ont décrit en détail l'organisation d'une unité de l'ARN ribosomique chez *Schizophyllum commune* (Schizophyllaceae Aphyllophorales); les régions 18S, 26S et 5,8S sont des régions codantes pour la synthèse de l'ARN ribosomique. Chaque unité peut être répétée plusieurs centaines de fois dans une cellule. La région 18S est celle étudiée par Hibbett & Donoghue (1995) pour les *Polyporaceae* et la région 26S celle étudiée par Gonzales (1991) pour *Rhizoctonia solani*. Les différentes régions ont évolué dans le même sens, mais la région ITS, non codante, a évolué plus rapidement, c'est-à-dire qu'elle a accumulé plus de mutations au cours du temps que les régions codantes..

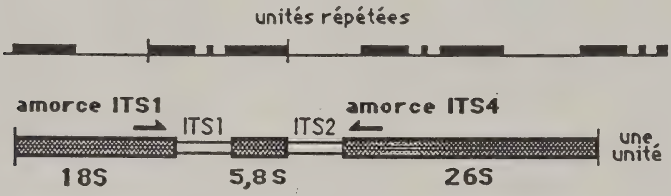


Figure 2 . Organisation d'une unité ribosomique de champignon et localisation des amorces ITS1 et ITS4 de White *et al.* (1990)

Amplification et séquençage. Les conditions de la PCR pour l'amplification des ITS ont été celles décrites par White *et al.* (1990) pour les champignons. L'ADN amplifié a été séquencé par la société Génome Express (15 avenue des Martyrs 38054 Grenoble Cedex 09, France). Les séquences ont été alignées en utilisant le programme CLUSTALV du logiciel PHYLIP (Felsenstein J. 1993. Phylogeny Inference Package. Version 3.5. Department of Genetics, University of Washington, Seattle). Les arbres phylogénétiques sont présentés sous la forme d'un arbre non enraciné (Figures 3 et 18) obtenus par la méthode dite de neighbour-joining, à l'issue de rééchantillonnages (*bootstrappings*) ou sous la forme d'arbres KITSCH (Figures 4 à 16) qui correspondent aux mêmes données que celles de l'arbre non enraciné.

RESULTATS

La figure 3 montre les relations de parentés entre les espèces d'Aphyllophorales. Les différentes grandes branches renferment - en principe - des groupes, ou taxons, naturels (groupes monophylétiques). Nous avons donné une dimension phylogénétique à ces taxons : chaque taxon a été considéré comme occupant un rang ordinal qui rassemble des familles. Ce

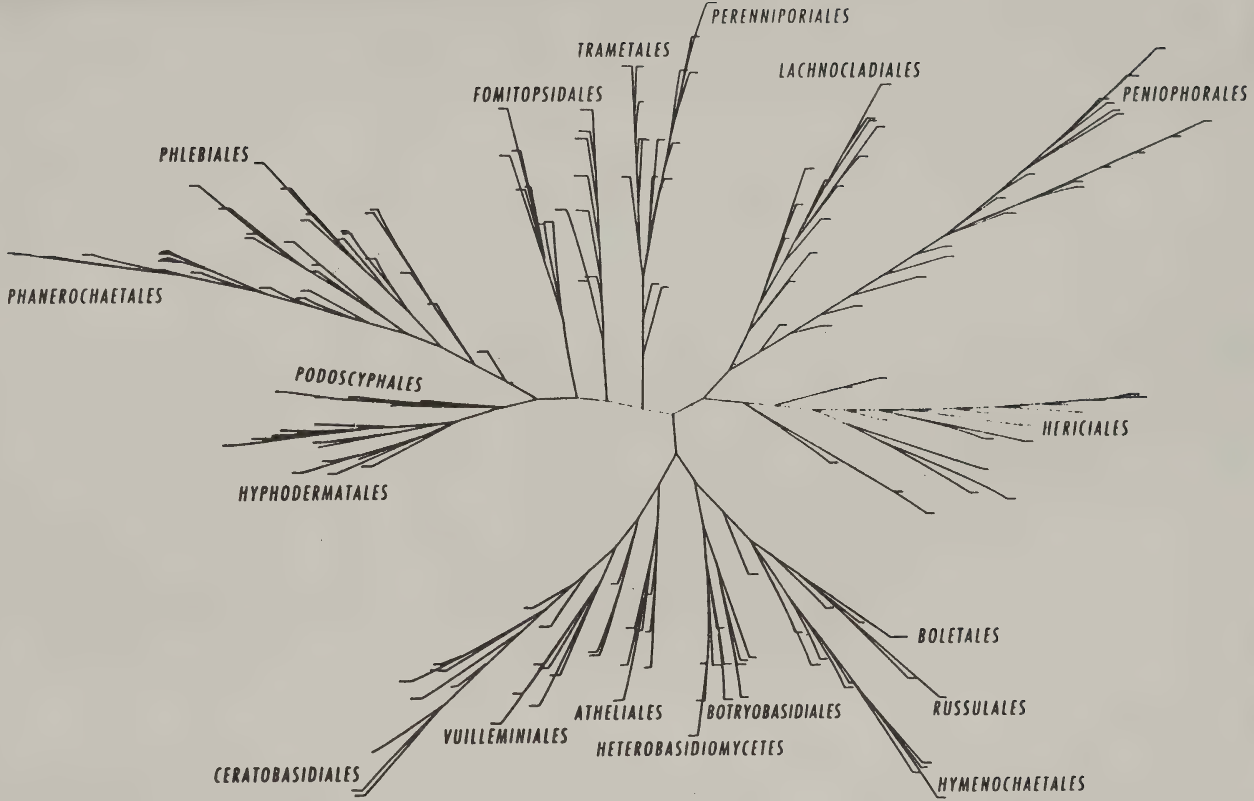

PERENNIPORIALES
TRAMETALES
LACHNOCLADIALES
FOMITOPSIDALES
PENIOPHORALES
PHLEBIALES
PHANEROCHAETALES
PODOSCYPHALES
HERICIALES
HYPHODERMATALES
BOLETALES
RUSSULALES
ATHELIALES
BOTRYOBASIDIALES
VUILLEMINIALES
HETEROBASIDIOMYCETES
HYMENOCHAETALES
CERATOBASIDIALES

Figure 3. Arbre phylogénétique des Aphyllophorales basé sur la comparaison des séquences des ITS.

point de vue est illustré en détail avec l'ordre des Héricìales et des dix familles qui le composent. L'emboîtement des branches entre elles permet d'émettre des hypothèses sur la parenté entre les ordres. Cette analyse, d'une grande échelle, suscite de très nombreuses remarques, et bouleverse sérieusement la classification admise aujourd'hui. La première déduction, qui était prévisible, c'est que l'aspect de l'hyménium, lisse, hydné, poré ou même lamellé, qui a toujours servi, étant perceptible à l'oeil nu, à fixer les grandes lignes de la classification, est trompeur. Les porés, assez nombreux dans notre étude, sont partagés sur plusieurs branches; il en est de même des Hydnés. De même, le port du basidiome, étalé, étalé-réfléchi, dimidié, substipité ou stipité n'est pas un critère de premier ordre pour définir ou distinguer ordres ou classes. Les Stéréales Jülich 1981 au basidiome réfléchi, se trouvent sur quatre branches bien distinctes.

Par contre, l'importance d'un caractère physico-chimique, l'amyloïdie de la paroi sporique est fortement mis en évidence. Ceci était déjà perceptible dans l'étude d'Hibbett & Donoghue (1995) où des genres à spores amyloïdes sont rassemblés dans leur groupe 2: *Bondarzewia* et *Heterobasidion* porés, *Lentinellus* lamellé, *Hericium* et *Echinodontium* hydnés sont côte à côte; par contre contrairement à nos résultats, les *Stereum* sont, chez ces auteurs, très éloignés, ainsi que les *Panellus* que nous n'avons pas traités. La position des Russules dans leur groupe 2 devrait être confirmée (Fig. 1).

Dans notre étude, la branche des Hériciales, que nous définirons plus loin, regroupe près de 90 % des espèces à spores amyloïdes testées ici; en sont exclus: *Amyloathelia amylacea* et les quatre *Dichostereum*. Cette exclusion des *Dichostereum* nous oblige à considérer comme encore plus significatif que l'amyloïdie, le caractère particulier des *Lachnocladiaceae* qui est de possèder des hyphes différenciées aux parois cyanophiles ou dextrinoïdes; ce sont soit des fibres simples ou peu ramifiées (genre *Scytinostroma*), soit des dichophyses (genres *Vararia* et *Dichostereum*), soit des astérophyses (genres *Asterostroma* et *Lachnocladium*). Cet ensemble, doit être reconnu comme un ordre, les Lachnocladiales Jülich 1981.

D'autres ordres ressortent de notre étude; ils sont placés sur la figure 3. Nous allons passer en revue la plupart de ces ordres et citer les familles qu'ils comportent. Nous traiterons ensuite du niveau générique et enfin du niveau spécifique.

A. Ordres reconnus et familles les composant

Nous traiterons ces ordres dans l'ordre alphabétique. Le travail de Jülich (1981) nous servira de référence.

ATHELIALES Jülich (Fig. 4)

Un très petit nombre d'espèces de cet ordre ont été traitées appartenant à la famille des *Atheliaceae* Jülich et aux genres *Athelia*, *Amyloathelia*, *Fibulomyces* et *Leptosporomyces*. L'*Athelia decipiens*, espèce sans boucles, se trouve par contre auprès d'*Erythricium laetum* en limite des Phlébiales.

Le genre *Amyloathelia* n'est pas, malgrè l'amyloïdie de ses spores, placé dans le grand ensemble des Héricíales. L'amyloïdie est donc apparue dans au moins trois phylums différents : Héricíales, Athéliales et Lachnocladiales.

La figue 4 montre aussi la position des ordres les plus voisins incorporés dans cette étude: les Botryobasidiales, les Cantharellales, les Bolétales, les Russulales et quelques espèces d'hétérobasidiés. *Phaeolus schweitnizii* (?Hyménochaetales) est placé à proximité des Hétérobasidiés.

BOTRYOBASIDIALES Jülich (Fig. 4)

Cet ordre comprend trois familles dont une seule a été utilisée ici, celle des *Botryobasidiaceae* (Parm.)Jül. avec *Botryobasidium*, *Candelabrochaete*. Si trois *Botryobasidium* se trouvent ensemble, *Candelabrochaete septocystidia* se trouve sur la branche menant au genre *Ceriporia* (Fig. 12) ; il faut le placer dans les Phanérochaetales.

CERATOBASIDIALES Jülich (Fig. 18)

A cause de l'importance des *Rhizoctonia* comme pathogènes des plantes, de nombreuses études moléculaires (Vilgalys et Cubeta, 1994) et séquences d'ITS ont été publiées ou déposées dans la banque de données (Mazzola *et al.* 1996, Boysen *et al.* 1996, Salazar *et al.* 1997, Kuninaga 1997).

Les *Ceratobasidiaceae* testées sont regroupées: *Ceratobasidium*, *Uthatobasidium*, *Waitea* et les *Rhizoctonia*, anamorphes de *Thanatephorus* et de *Ceratobasidium*. Les relations phylogénétiques de 16 groupes et sous-groupes

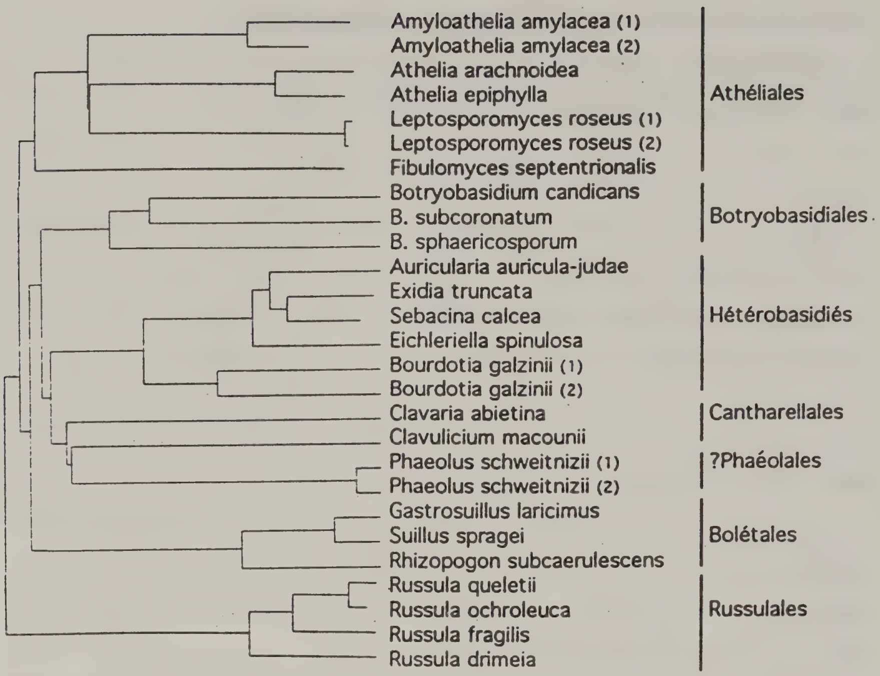

Amyloathelia amylacea (1)
Amyloathelia amylacea (2)
Athelia arachnoidea
Athelia epiphylla
Leptosporomyces roseus (1)
Leptosporomyces roseus (2)
Fibulomyces septentrionalis
Botryobasidium candicans
B. subcoronatum
B. sphaericosporum
Auricularia auricula-judae
Exidia truncata
Sebacina calcea
Eichleriella spinulosa
Bourdotia galzinii (1)
Bourdotia galzinii (2)
Clavaria abietina
Clavulicium macounii
Phaeolus schweitnizii (1)
Phaeolus schweitnizii (2)
Gastrosuillus laricimus
Suillus spragei
Rhizopogon subcaerulescens
Russula queletii
Russula ochroleuca
Russula fragilis
Russula drimeia
Athéliales
Botryobasidiales
Hétérobasidiés
Cantharellales
?Phaéolales
Bolétales
Russulales

Figure 4. Arbre phylogénétique des espèces montrant les relations entre les Athéliales, les Botryobasidiales, les Hétérobasidiés, les Cantharellales, les ?Phaéolales, les Bolétales et les Russulales

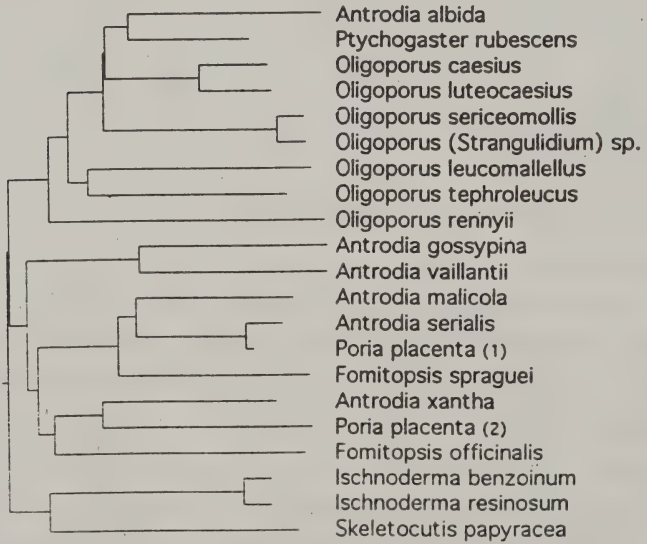

Antrodia albida
Ptychogaster rubescens
Oligoporus caesius
Oligoporus luteocaesius
Oligoporus sericeomollis
Oligoporus (Strangulidium) sp.
Oligoporus leucomallellus
Oligoporus tephroleucus
Oligoporus rennyii
Antrodia gossypina
Antrodia vaillantii
Antrodia malicola
Antrodia serialis
Poria placenta (1)
Fomitopsis spraguei
Antrodia xantha
Poria placenta (2)
Fomitopsis officinalis
Ischnoderma benzoinum
Ischnoderma resinosum
Skeletocutis papyracea

Figure 5. Arbre phylogénétique des Fomitopsidales

d'anastomoses décrits chez *R. solani* sont présentées dans le paragraphe Identifications des anamorphes.

FOMITOPSIDALES Jülich 1981, *emend.* (Fig. 5)

La figure 5 est faite de polypores presque tous responsables de pourriture brune (à l'exception des *Ischnoderma* et *Skeletocutis*). Nous enlevons de cet ordre les *Heterobasidiaceae* Jül. aux spores amyloïdes que nous plaçons dans les Héricialès. Par contre, le genre *Antrodia* doit être retiré des Coriolales et placé ici dans les Fomitopsidales. D'autre part, *Strangulidum* a été synonymisé à *Oligoporus* par Ryvarden et Gilbertson (1993b), et *Ptychogaster rubescens* que Stalpers (1978) considère comme l'anamorphe de *Punctularia*, est signalé par Davidson *et al.* (1946) comme l'anamorphe d'*Oligoporus gutulatus*; leur position ici est donc normale.

Les *Gloeophyllaceae*, malgrè leur pourriture brune, ne sont pas situées parmi les Fomitopsidales, mais sont isolées en marge des Trametales (Fig. 15). La branche des *Gloeophyllaceae* occupe une position peu robuste dans l'arbre, c'est-à-dire qu'elle peut occuper des positions différentes selon les espèces comparées. Dans l'étude de Hibbett & Donoghue (1995), le *Gloeophyllum sepiarium* est à coté des *Suillus* (Fig. 1). Trop peu de représentants de cette famille ont été testés pour être plus précis (?Gloéophyllales).

HERICIALES Jülich 1981, *emend.* (Fig. 6)

Le regroupement de la plupart des genres à spores amyloïdes, qu'ils soient corticiés, hydnés ou porés sur une même branche nous incite à reconnaître un ordre très vaste, celui des Hériciales. Les données d'Hibbett & Donoghue (1995) y ajoutent les *Lentinellus* lamellés (Fig. 1) que nous n'avons pas testé. Cet ordre correspond aux *Auriscalpiaceae* Maas Geest. 1963 *sensu* Wu 1996. Nous y plaçons :

Acanthophysiaceae *fam. nov.* avec *Acanthophysium* et *Xylobolus.*

Aleurodiscaceae Pilat 1934 *emend.*, réservé à des genres à spores ornées : *Aleurodiscus*, *Acanthobasidium*, *Aleurobotrys*, et ? *Aleurocystidiellum.*

Amylostereaceae *fam. nov.* avec *Amylostereum.*

Auriscalpiaceae Maas Geest. 1963 avec *Auriscalpium*, *Dentipratulum*, *Gloiodon.*

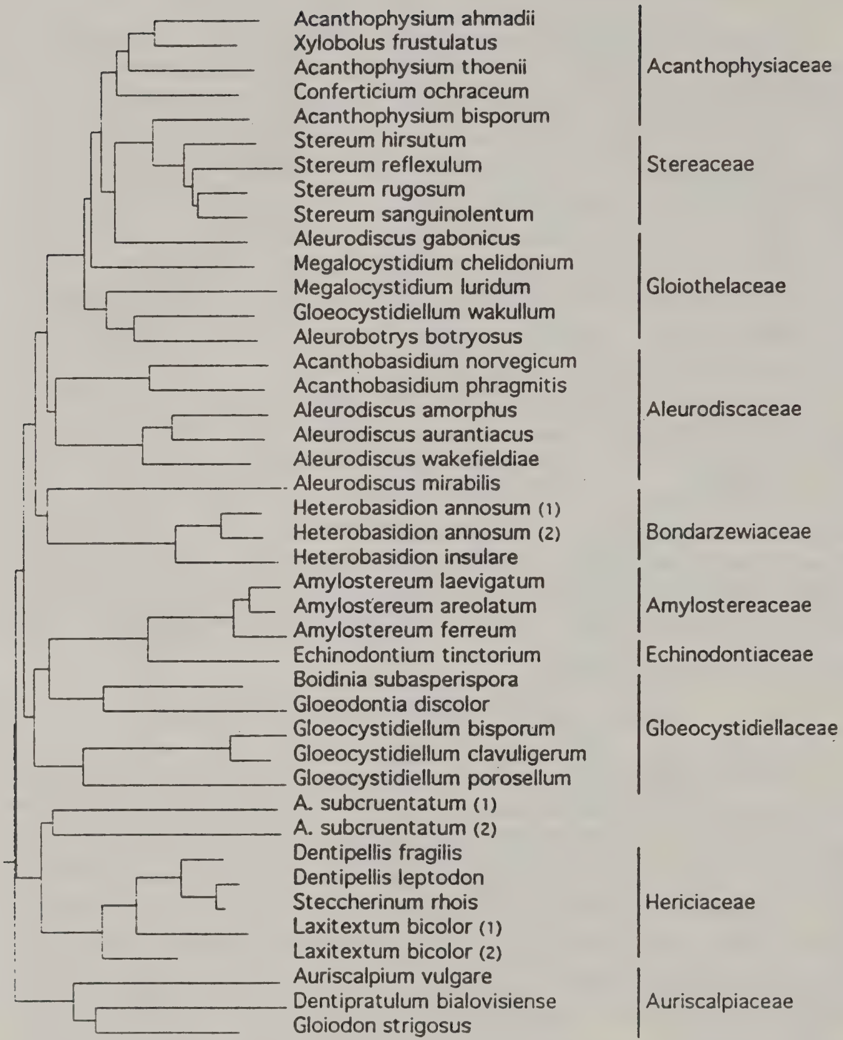

Acanthophysium ahmadii
Xylobolus frustulatus
Acanthophysium thoenii
Conferticium ochraceum
Acanthophysium bisporum
Stereum hirsutum
Stereum reflexulum
Stereum rugosum
Stereum sanguinolentum
Aleurodiscus gabonicus
Megalocystidium chelidonium
Megalocystidium luridum
Gloeocystidiellum wakullum
Aleurobotrys botryosus
Acanthobasidium norvegicum
Acanthobasidium phragmitis
Aleurodiscus amorphus
Aleurodiscus aurantiacus
Aleurodiscus wakefieldiae
Aleurodiscus mirabilis
Heterobasidion annosum (1)
Heterobasidion annosum (2)
Heterobasidion insulare
Amylostereum laevigatum
Amylostereum areolatum
Amylostereum ferreum
Echinodontium tinctorium
Boidinia subasperispora
Gloeodontia discolor
Gloeocystidiellum bisporum
Gloeocystidiellum clavuligerum
Gloeocystidiellum porosellum
A. subcruentatum (1)
A. subcruentatum (2)
Dentipellis fragilis
Dentipellis leptodon
Steccherinum rhois
Laxitextum bicolor (1)
Laxitextum bicolor (2)
Auriscalpium vulgare
Dentipratulum bialovisiense
Gloiodon strigosus
Acanthophysiaceae
Stereaceae
Gloiothelaceae
Aleurodiscaceae
Bondarzewiaceae
Amylostereaceae
Echinodontiaceae
Gloeocystidiellaceae
Hericiaceae
Auriscalpiaceae

Figure 6. Arbre phylogénétique des Hériciales
(A = *Aleurocystidiellum*)

Bondarzewiaceae Kotl. & Pouz. 1957 (synonymes: *Amylariaceae* Corner 1970, *Amylosporaceae* Jül. 1981, *Heterobasidiaceae* Jül. 1981, *Wrightoporiaceae* Jül. 1981) avec *Amylonotus, Amylosporus, Bondarzewia, Heterobasidion* et *Wrightoporia.*

Echinodontiaceae Donk 1961 avec *Echinodontium* et *Laurilia.*

Gloeocystidiellaceae (Parm.)Jül. 1981, *emend.* reservés à des genres à spores ornées: *Gloeocystidiellum, Amylosporomyces, Boidinia, Dextrinocystidium, Gloeocystidiopsis, Gloeodontia, Gloeopeniophorella* et *Scytinostromella.*

Gloiothelaceae *fam. nov.* pour les ex-*Gloeocystidiellaceae* à spores lisses: *Gloiothele, Megalocystidium,* et peut-être *Amylofungus* Wu 1995 et *Gloeomyces* Wu 1996.

Hericiaceae Donk 1964 (inclus *Clavicoronaceae* Corner 1970): *Hericium, Artomyces, Clavicorona, Creolophus, Dentipellis, Mucronella, Stecchericium* et *Laxitextum.*

Lentinellaceae Kotl. & Pouz. 1972 : *Lentinellus.*

Stereaceae Pilat 1930 *emend.* : *Stereum.*

Ces propositions rejoignent celles de Wu (1996) qui place, dans ce qu'il nomme *Auriscalpiaceae*, les *Aleurodiscoideae* et les *Stereoideae*, et celle de Stalpers (1996) qui y joint les *Echinodontiaceae*; mais nous ne suivons pas ce dernier pour les *Lachnocladiaceae*. Nous avons, par contre, ajouté les *Amylostereaceae* et les *Acanthophysiaceae* et *Gloiothelaceae.* En effet, sur l'arbre, les *Gloeocystidiellaceae* sont nettement partagées en deux rameaux, l'un à spores lisses, l'autre à spores ornées. De même, les *Aleurodiscaceae* sont pour les mêmes raisons en deux branches; la famille des *Acanthophysiaceae* regroupe les genres *Acanthophysium* et *Xylobolus* à spores lisses ; *Xylobolus frustulatus* longtemps considéré comme un *Stereum*, se trouve ici placé auprès d'*Acanthophysium* qui possède, comme lui, des acanthophyses. Un problème reste posé pour le genre *Conferticium* dont les spores sont, soit lisses (*C. ochraceum* et *insidiosum*), soit ornées (*C. heimii* et *ravum*); nous n'avons testé que *C. ochraceum* qui s'est placé avec les genres à spores lisses.

D'autres questions se posent : la position de *Aleurocystidiellum subcruentatum*, de l'*Acanthophysium bisporum*, de l'*Aleurobotrys botryosus* ou encore de l'*Aleurodiscus gabonicus*; ce dernier est, certes, un *Aleurodiscus* très spécial, le seul connu pour avoir des boucles opposées ou verticillées sur les hyphes larges de ses cultures, comme les *Stereum* tout proche dans l'arbre, mais il a des spores ornées, mais non échinulées comme celles des *Aleurodiscus sensu stricto.* Le *Gloeocystidiellum wakullum* placé dans le genre *Stereum* par Wu (1996) se trouve auprès de *Megalocystidium luridum*, à spores lisses comme lui, mais pas au milieu des *Stereum* !

Comme nous le notions en introduction, l'importance de l'amyloïdie sporique soulignée par cette étude bouleverse les classifications admises. Une comparaison avec l'étude cladistique de Parmasto (1995) est très révélatrice des bouleversements proposés qui nous a amené à placer ensemble trois branches éloignées dans sa figure 1.

HYMENOCHAETALES Oberw. 1977 (Fig. 7)

Nos résultats, et surtout ceux d'Hibbett & Donoghue (1995) permettent de situer dans cet ordre avec certitude :

Hymenochaetaceae Donk 1948: *Hymenochaete*
Coltriciaceae : *Coltricia*, *Inonotus* et *Phylloporia*
Phellinaceae : *Phellinus*

On aimerait avoir confirmation que le genre *Asterodon*, qui n'a pas été testé, se place dans les *Hymenochaetaceae* plutôt que dans les Lachnocladiales. *Phaeolus schweinitzii*, à pourriture "rouge" (Fig. 3, groupe 7 et Fig. 4) mérite un place tout à fait à part des Hyménochaetales auprès desquels il avait été rattaché (Fiasson et Niemelä, 1984). D'après Hibbett & Donoghue (1995), *Phaeolus* et *Laetiporus* sont monophylétiques.

HYPHODERMATALES Jülich 1981 (Fig. 8)

Jülich y place trente six genres répartis dans huit familles. Nous n'avons testé que neuf de ces genres. Nous ne plaçons pas ici les *Bjerkanderaceae* Jül. car le genre type se trouve non loin des *Ceriporia* (Phanérochaetales). Nos tests permettent de situer dans cet ordre avec sécurité :

Hyphodermataceae Jül. : *Hyphoderma* et *Hypochnicium*, mais pas le genre *Hyphodermella* qui est sur la branche des Phanérochaetales.

Meripilaceae Jül. à prendre dans les Grifolales Jül.

Steccherinaceae Parm. 1968 : *Steccherinum*, *Junghunia*, auprès desquels se trouvent deux *Antrodiella* qu'il faut donc enlever des *Coriolaceae*, dont les représentants se

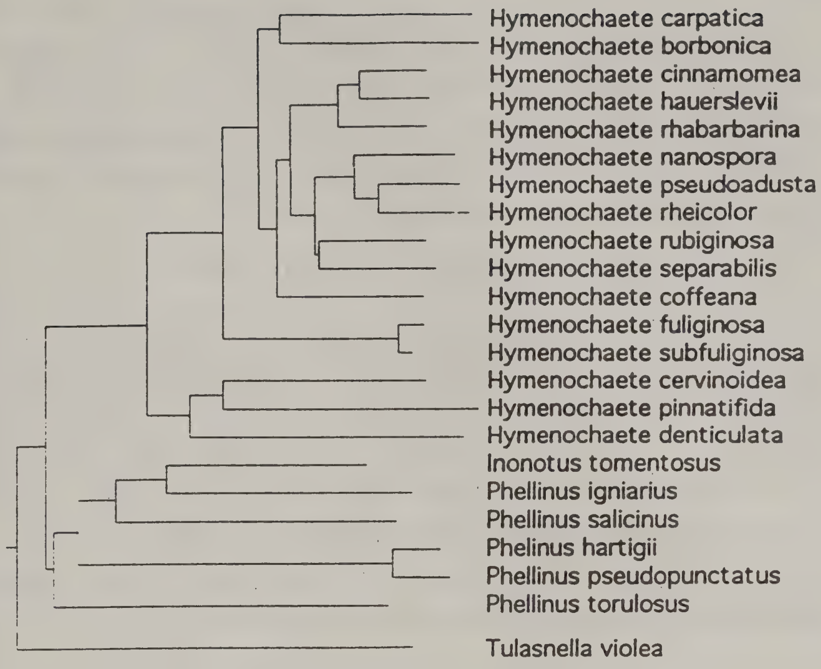

Hymenochaete carpatica
Hymenochaete borbonica
Hymenochaete cinnamomea
Hymenochaete hauerslevii
Hymenochaete rhabarbarina
Hymenochaete nanospora
Hymenochaete pseudoadusta
Hymenochaete rheicolor
Hymenochaete rubiginosa
Hymenochaete separabilis
Hymenochaete coffeana
Hymenochaete fuliginosa
Hymenochaete subfuliginosa
Hymenochaete cervinoidea
Hymenochaete pinnatifida
Hymenochaete denticulata
Inonotus tomentosus
Phellinus igniarius
Phellinus salicinus
Phelinus hartigii
Phellinus pseudopunctatus
Phellinus torulosus
Tulasnella violea

Figure 7. Arbre phylogénétique des Hyménochaetales

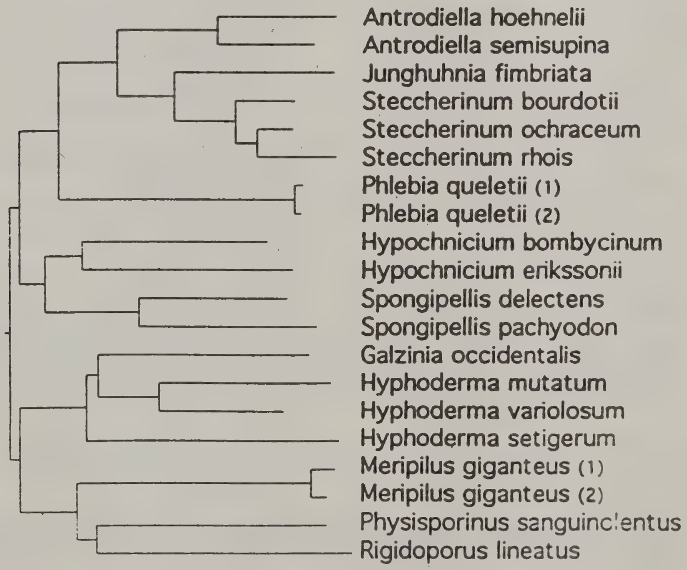

Antrodiella hoehnelii
Antrodiella semisupina
Junghuhnia fimbriata
Steccherinum bourdotii
Steccherinum ochraceum
Steccherinum rhois
Phlebia queletii (1)
Phlebia queletii (2)
Hypochnicium bombycinum
Hypochnicium erikssonii
Spongipellis delectens
Spongipellis pachyodon
Galzinia occidentalis
Hyphoderma mutatum
Hyphoderma variolosum
Hyphoderma setigerum
Meripilus giganteus (1)
Meripilus giganteus (2)
Physisporinus sanguinolentus
Rigidoporus lineatus

Figure 8. Arbre phylogénétique des Hyphodermatales

répartissent en outre sur deux autres branches, celle des Fomitopsidales et celle des Pérenniporiales. L'ancien *Phlebia queletii* devenu *Steccherinum queletii* (Bourd. & Galz.)Hall. & Hjortst. 1988, s'est placé non loin des représentants de ce genre. Le *Galzinia occidentalis* Rogers, transféré récemment (Boidin & Gilles, 1994) dans le genre *Hyphoderma* se trouve avec les trois espèces de ce genre étudiées ici.

LACHNOCLADIALES Jülich 1981 (Fig. 9)

Comme dit dans l'introduction, cet ordre contient à la fois, des espèces à spores amyloïdes (genre *Dichostereum*), - nous regrettons de n'avoir pu tester des *Scytinostroma* ou des *Vararia* à spores amyloïdes, et une majorité d'espèces à spores non amyloïdes ou avec seulement une 'bavette' amyloïde (*Scytinostroma* du groupe *galactinum* par exemple). Ceci souligne l'importance du caractère dextrinoïde et cyanophile des parois de leurs fibres, dichophyses ou astérophyses. Celui-ci est connu dans des genres clavarioïdes (*Lachnocladium*), ou stipités (*Dicantharellus, Dichopleuropus*) non testés à ce jour.

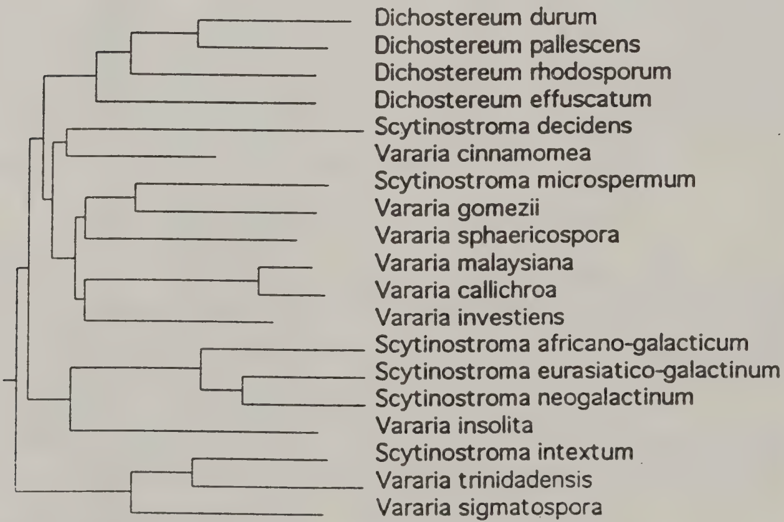

Dichostereum durum
Dichostereum pallescens
Dichostereum rhodosporum
Dichostereum effuscatum
Scytinostroma decidens
Vararia cinnamomea
Scytinostroma microspermum
Vararia gomezii
Vararia sphaericospora
Vararia malaysiana
Vararia callichroa
Vararia investiens
Scytinostroma africano-galacticum
Scytinostroma eurasiatico-galactinum
Scytinostroma neogalactinum
Vararia insolita
Scytinostroma intextum
Vararia trinidadensis
Vararia sigmatospora

Figure 9. Arbre phylogénétique des Lachnocladiales

PENIOPHORALES *ord. nov.* (Fig. 10)

Vingt cinq *Peniophora* et *Duportella* forment une branche nettement autonome à laquelle il faut reconnaître le rang d'ordre. Jülich les place dans deux familles, *Peniophoraceae* et *Duportellaceae* de son ordre des Stéréales. Nous avons déjà transféré deux familles de cet ordre: *Echinodontiaceae* et *Stereaceae*, aux spores amyloïdes, dans les Héricilales. Nous plaçons ici des genres à sporée rose ou orangée, gloéocystidiés et très souvent à métuloïdes. L'ensemble de ces caractères ne se retrouve pas chez les *Lopharia*, que l'on trouve sur d'autres branches de notre arbre (Fig. 15), que Jülich intégrait dans les *Duportellaceae*. Une seule famille constitue cet ordre, celle des *Peniophoraceae* Maire 1902 *emend.* avec le genre *Peniophora* (inclus *Duportella*, voir plus loin).

PERENNIPORIALES Jülich 1981 (Fig. 11)

Cet ordre comprend les *Perenniporiaceae* Jül. et les *Ganodermataceae* Donk 1948. Nous n'avons pas testé de *Pachykytosporaceae.*

Les cinq espèces de *Perenniporia* traités se situent près des *Ganoderma*. Nous proposons de synonymiser l'ordre des Ganodermatales Jül. à celui des Pérenniporiales, à propos desquels Jülich écrivait d'ailleurs: "cet ordre est peut être relié aux Ganodermatales qui diffèrent cependant par leurs spores à endospore ornementée". Dans l'étude d'Hibbet & Donoghue (1995), les *Polyporus* étudiés se situent dans ce taxon.

La figure 11 associe à ces derniers les *Epithele*, genre habituellement traité avec les Corticiés et un *Porogramme*. Les *Epitheleaceae* Jül. n'ont donc pas leur place dans les *Aleurodiscales*, ordre composite que nous avons éclaté, ni dans les *Aleurodiscaceae* dont ils n'ont pas les spores amyloïdes, orangées et ornées. Les trouver auprès des porés laisse penser que les émergences stériles sont des restes ou au contraire des départs de pores.

PHANEROCHAETALES Jülich 1981 (Fig. 12)

La partie supérieure de la figure 12 comporte cinq *Phanerochaete*, *Efibula pallidovirens* (Bourd. & Galz.)Wu 1990 (ancien *Phanerochaete*), *Hyphodermella corrugata*, *Cotylidia diaphana* et *Climacodon pulcherrimus*, toutes espèces

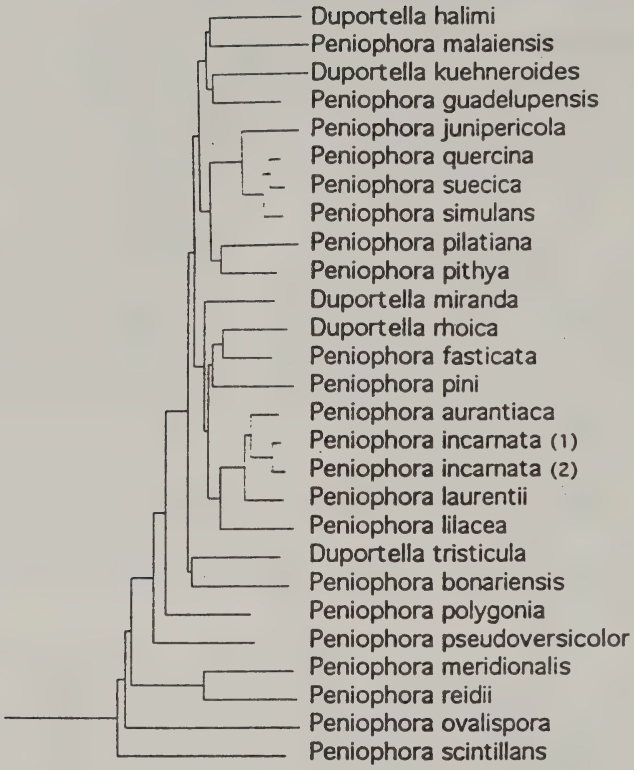

Duportella halimi
Peniophora malaiensis
Duportella kuehneroides
Peniophora guadelupensis
Peniophora junipericola
Peniophora quercina
Peniophora suecica
Peniophora simulans
Peniophora pilatiana
Peniophora pithya
Duportella miranda
Duportella rhoica
Peniophora fasticata
Peniophora pini
Peniophora aurantiaca
Peniophora incarnata (1)
Peniophora incarnata (2)
Peniophora laurentii
Peniophora lilacea
Duportella tristicula
Peniophora bonariensis
Peniophora polygonia
Peniophora pseudoversicolor
Peniophora meridionalis
Peniophora reidii
Peniophora ovalispora
Peniophora scintillans

Figure 10 . Arbre phylogénétique des Péniophorales

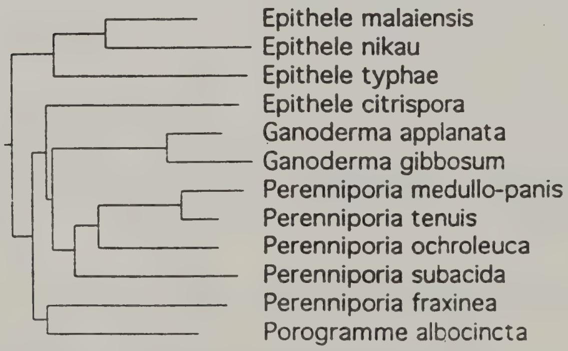

Epithele malaiensis
Epithele nikau
Epithele typhae
Epithele citrispora
Ganoderma applanata
Ganoderma gibbosum
Perenniporia medullo-panis
Perenniporia tenuis
Perenniporia ochroleuca
Perenniporia subacida
Perenniporia fraxinea
Porogramme albocincta

Figure 11 . Arbre phylogénétique des Péréniporiales monomitiques sans boucles ou à boucles rares parfois opposées ou verticillées sur les hyphes larges. Le genre *Cotylidia* n'est donc plus dans les *Podocyphaceae*, stipités comme lui, mais dimitiques et bouclés.

On trouve ici d'autres espèces monomitiques sans boucles, avec, notamment, les genres *Ceriporia* (*Rigidoporaceae* Jül.), *Phlebiopsis* (*Phanerochaete* pour Jülich 1981), familles placées dans les Phanérochaetales, mais encore *Erythricium* et *Leptoporus* (non situés par Jülich), et *Candelabrochaete septocystidia* qui était un *Phanerochaete* pour Eriksson & Ryvarden (1978).

Par contre la position des *Bjerkandera*, *Crustoderma* et du *Pulcherricium caeruleum* bouclés reste à expliquer. Notons cependant qu'Hibbett & Donoghue (1995) placent déjà ce dernier à proximité de *Phanerochaete chrysosporium* (Fig. 1). La similitude génétique des *Bjerkandera*, *Pulcherricium* et *Phanerochaete*, soulignée par ces auteurs et confirmée dans notre étude, montre encore une fois l'imbrication d'espèces autrefois classées dans les *Polyporaceae* et les *Corticiaceae*.

PHLEBIALES *ord. nov.* (Fig. 13)

Depuis que Nakasone et Burdsall (1984) ont synonymisé *Merulius* à *Phlebia* en transférant le type, *Merulius tremellosus* dans ce genre, la famille des *Meruliaceae* et l'ordre des Méruliales sont caduques. Il faut parler des Phlébiales *ord. nov.* et de *Phlebiaceae* Jül. Les *Phlebiaceae* sont regroupées sur la Figure 13; on y trouve les genres *Mycoacia*, *Phlebia*, et le *Ceriporiopsis gilvescens*, mais le *C. pannocincta* est à quelque distance. L'étude d'autres espèces de ce genre et l'étude des caractères culturaux de ce genre permettront de savoir si sa place est bien dans cette famille. Les *Phlebia*, et à un moindre titre les *Mycoacia*, sont astatocénocytiques, c'est-à-dire que leurs hyphes bouclées en aérobiose sont capables de poursuivre leur croissance en anaérobiose, mais alors leurs cloisons transversales s'espacent, ne portent plus de boucles, et leurs articles sont multinucléés. C'est, sans doute, une utile capacité pour pénétrer profondément dans le bois, même là où l'oxygène manque.

Nakasone (1996), après étude de l'ADN, transfère *Auriculariopsis ampla* (Lév.)Maire comme *Schizophyllum amplum* et *Cytidiella melzeri* Pouz. comme *Phlebia albo-mellea*

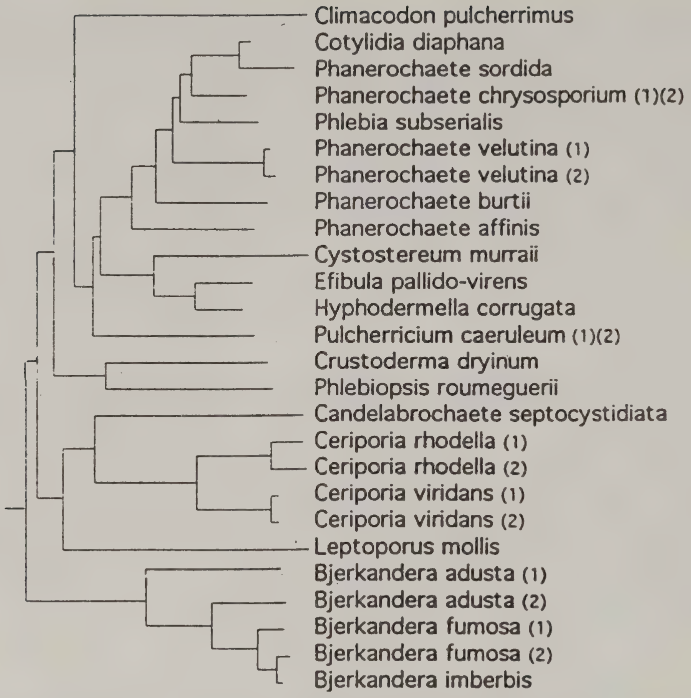

Climacodon pulcherrimus
Cotylidia diaphana
Phanerochaete sordida
Phanerochaete chrysosporium (1)(2)
Phlebia subserialis
Phanerochaete velutina (1)
Phanerochaete velutina (2)
Phanerochaete burtii
Phanerochaete affinis
Cystostereum murraii
Efibula pallido-virens
Hyphodermella corrugata
Pulcherricium caeruleum (1)(2)
Crustoderma dryinum
Phlebiopsis roumeguerii
Candelabrochaete septocystidiata
Ceriporia rhodella (1)
Ceriporia rhodella (2)
Ceriporia viridans (1)
Ceriporia viridans (2)
Leptoporus mollis
Bjerkandera adusta (1)
Bjerkandera adusta (2)
Bjerkandera fumosa (1)
Bjerkandera fumosa (2)
Bjerkandera imberbis

Figure 12 . Arbre phylogénétique des Phanérochaetales

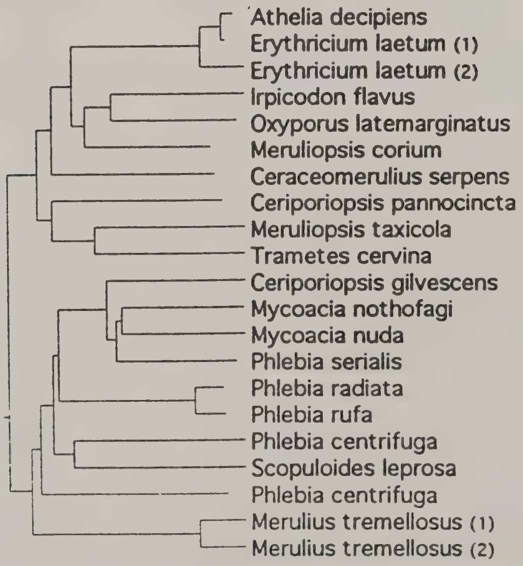

Athelia decipiens
Erythricium laetum (1)
Erythricium laetum (2)
Irpicodon flavus
Oxyporus latemarginatus
Meruliopsis corium
Ceraceomerulius serpens
Ceriporiopsis pannocincta
Meruliopsis taxicola
Trametes cervina
Ceriporiopsis gilvescens
Mycoacia nothofagi
Mycoacia nuda
Phlebia serialis
Phlebia radiata
Phlebia rufa
Phlebia centrifuga
Scopuloides leprosa
Phlebia centrifuga
Merulius tremellosus (1)
Merulius tremellosus (2)

Figure 13 . Arbre phylogénétique des Phlébiales

(Burds.)Nakas. La famille des *Auriculariopsidaceae* Jül. 1981 est donc fusionnée avec celle des *Phlebiaceae.* La présence de *Scopuloides leprosa*, ancien *Phanerochaete*, parmi les *Phlebia* peut étonner; contrairement aux *Phanerochaete* homothalles, il s'est révélé hétérothalle bipolaire (Boidin *et al.* 1993) comme le sont les *Phlebiaceae.*

Nous ne pensons pas que les familles des *Amylocorticiaceae* Jül., des *Dacryobolaceae* Jül. ou encore des *Panellaceae* Jül. et des *Plicaturaceae* Jül., placées par Jülich (1981) dans les Méruliales, aient leur place dans les Phlébiales, mais nous n'avons pas testé de représentants de ces familles.

PODOSCYPHALES *ord. nov.* (Fig. 14)

La famille des *Podoscyphaceae* Reid 1965 que Jülich (1981) place dans les Polyporales, ordre composite, n'y a pas sa place. Formant une branchette à part, nous l'éléverons au niveau d'ordre.

La présence, à proximité, d'*Hypochnicium cystidiatum*, espèce africaine comme la plupart des Podoscyphaceae testées ici, ne pourrait s'expliquer que par une erreur de numérotation, lors de l'envoi des sporées ou lors de repiquages ultérieurs fréquents depuis la récolte en 1967.

Se placent ici les genres *Podoscypha, Cymatoderma* auxquels on peut joindre *Aquascypha* Reid. Nous n'y mettons pas les *Cotylidia* placés avec les Phanérochaetales, ni les *Stereopsis.*

TRAMETALES *ord. nov.* (Fig. 15)

Les genres *Trametes* et *Lenzites* sont placés par Jülich dans les *Coriolacaeae* Singer 1961, où il voisinent avec les *Antrodia* que nous plaçons dans les Fomitopsidales, et les *Antrodiella* transférés dans les Hyphodermatales. Il faut donc restreindre la famille des *Coriolaceae*, mais son type, le genre *Coriolus* Quél. 1886, a été synonymisé à *Trametes* Fr. 1836. Il faut donc parler de *Trametaceae fam. nov.* et de Tramétales *ord. nov.*

Par contre, la figure 15 associe aux *Lenzites* et *Trametes* les *Lopharia* qui n'ont donc pas leur place dans les *Duportellaceae* Jül. dont ils n'ont ni les spores orangées, ni les gloéocystides.

Les Trametales comprendraient :

***Trametaceae** fam. nov.* : *Trametes* et *Lenzites.*

***Lophariaceae** fam. nov.* : *Lopharia* et, sans doute, *Porostereum.*

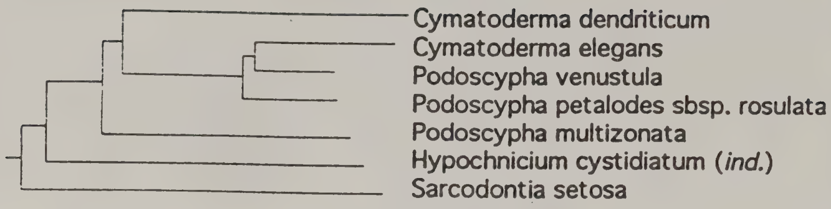

Cymatoderma dendriticum
Cymatoderma elegans
Podoscypha venustula
Podoscypha petalodes sbsp. rosulata
Podoscypha multizonata
Hypochnicium cystidiatum (*ind.*)
Sarcodontia setosa

Figure 14 . Arbre phylogénétique des Podoscyphales (la dénomination de *Hypochnicium cystidiatum* est incertaine.)

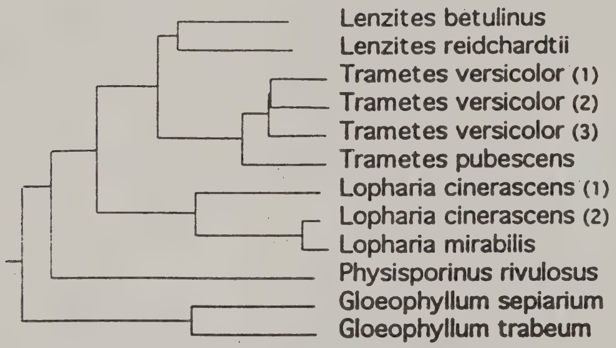

Lenzites betulinus
Lenzites reidchardtii
Trametes versicolor (1)
Trametes versicolor (2)
Trametes versicolor (3)
Trametes pubescens
Lopharia cinerascens (1)
Lopharia cinerascens (2)
Lopharia mirabilis
Physisporinus rivulosus
Gloeophyllum sepiarium
Gloeophyllum trabeum

Figure 15 . Arbre phylogénétique des Tramétales

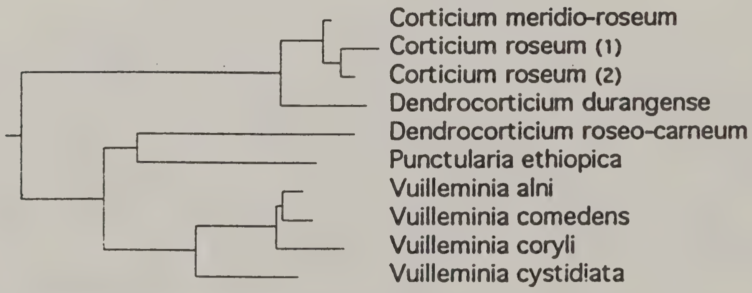

Corticium meridio-roseum
Corticium roseum (1)
Corticium roseum (2)
Dendrocorticium durangense
Dendrocorticium roseo-carneum
Punctularia ethiopica
Vuilleminia alni
Vuilleminia comedens
Vuilleminia coryli
Vuilleminia cystidiata

Figure 16 . Arbre phylogénétique des Vuilleminiales

VUILLEMINIALES *ord. nov.* (Fig. 16)

Nous plaçons ici deux familles mises par Jülich dans les Aleurodiscales, mais à spores non amyloïdes.

Vuilleminiaceae Maire 1902 : *Vuilleminia*, *Corticium*, *Dentocorticium*, *Dendrocorticium*; on peut ajouter *Dendrothele* que nous n'avons pas testé.

Punctulariaceae Donk 1964 : *Punctularia*.

Nous n'avons pas testé de *Cyphellaceae* ni de *Cytidiaceae*.

B. Validité de certains genres, sous-genres ou sections

1. Les genres *Vararia* et *Scytinostroma* (Fig. 9)

Ces genres, étroitement apparentés, diffèrent par la richesse en fibres des *Scytinostroma*, fibres qui peuvent parfois se ramifier dichotomiquement, et montrer dans l'hyménium, des extrémités d'aspect dichophytique. A l'inverse, les *Vararia* sont, avant tout, possesseurs de dichophyses nées sur un stipe assez court et à paroi mince sauf à proximité de leur première ramification. Il existe cependant des espèces dont le stipe des dichophyses plus long et à paroi épaisse prend une allure de fibre. Aussi Boidin et Lanquetin (1987) écrivaient : "il n'est pas possible, aujourd'hui, de tracer une frontière nette entre les genres *Scytinostroma* et *Vararia* ..." L'arbre obtenu confirme cette difficulté. Trouver *Vararia insolita* Boid. et Lanq. auprès de *Scytinostroma* indiscutables du groupe *galactinum*, nous incite à transférer cette espèce comme *Scytinostroma insolitum* (Boid. & Lanq.) *comb. nov.** Lors de son étude, Boidin *et al.* (1980) écrivaient: "les caractères de *V. insolita* sont à la fois ceux d'un *Scytinostroma* pour le contexte et ceux d'un *Vararia* pour la partie verticale".

A l'inverse, *Scytinostroma intextum*, qui montre des fibres à la base, mais qui passent à des dichophyses hyméniales racémeuses assez semblables à celles de *V. sigmatospora* doit être transféré comme *Vararia intexta* (Boidin & Lanquetin, 1987) *nov. comb.***; tous deux ont des spores allongées, fusiformes et des sporées rosâtres. On pourrait aussi songer à transférer *Vararia cinnamomea*, dont le stipe de ses dichophyses est fibriforme, dans le genre *Scytinostroma*, ce qui justifierait de le trouver ici auprès de *Sc. decidens* ! Mais on ne peut envisager de tels changements de genre pour *V. gomezii* ou *Sc. microspermum.* Il faut reconnaître que même après ces corrections, les deux genres s'entremêlent et ne se trouvent pas sur des rameaux distincts, contrairement aux espèces du genre *Dichostereum*, bien regroupées.

* *Vararia insolita* Boid. & Lanq., Bull. Soc. Mycol. France, 91 : 462, 1976.
** *Scytinostroma intextum* Boid., Lanq. & Gilles *ap.* Boid. & Lanq. Bibl. Mycol. 114 : 64, 1987

2. Le genre *Peniophora* (Fig. 10 et Tableau 1)

Il a été découpé en plusieurs sous-genres, et deux d'entr'eux ont même été considérés comme des genres autonomes: *Duportella* par Hjortstam (1987) et *Dendrophora* par Chamuris (1987), ce dernier absent de cette étude. Hallenberg *et al.* (1996), après étude de l'ITS2 de 25 espèces, les répartissent en quatre groupes. L'étude de 26 espèces dont onze préalablement étudiées par Hallenberg *et al.* (1996), confirme ces groupes. Le tableau 1 montre la position des 40 espèces testées. On voit, de suite, que ces groupes ne correspondent pas aux genres et sous-genres admis à ce jour (Boidin 1994). Le genre *Duportella* se disperse dans trois groupes. Les deux *Cristodendrella* comme les deux *Cryptochaete* sont séparés, ce qui laisse entendre que la présence de dendrophyses n'est pas une preuve de parenté. Les *Gloeopeniophora*, caractérisés par leurs hyphes basales non brunies d'où leurs couleurs vives dans les tons orangés se répartissent en trois groupes; toutefois les cinq espèces du groupe 3 ont des sulfocystides.

3. Le genre *Hymenochaete* (Fig. 7 et Tableau 2)

Pour découper ce grand genre quatre sections ont été proposées, basées sur la présence ou l'absence d'un cortex, et sur la présence ou l'absence de setae en-dessous de l'hyménium (Léger, 1990). Ce découpage n'est pas confirmé par l'étude des ITS. De même, l'arbre dressé par Parmasto (1995) à partir de nombreux caractères macro- et micromorphologiques, ne possède pas de branches correspondant aux groupes issus des ITS.

Tableau 1. Répartition des espèces de *Peniophora* et *Duportella* dans les groupes basés sur les séquences des ITS. * espèces testées par Hallenberg *et al.* (1996); ° espèces testées par nous.

	groupe 1	groupe 2	groupe 3	groupe 4
PENIOPHORA subgenus Peniophora	quercina*° suecica° simulans*° junipericola° bonariensis° malaiensis° guadelupensis° piceae* pithya*° manshurica* rufomarginata* pilatiana*° limitata*	cinerea* nuda* pseudonuda* violaceolivida*		reidi*° rufa* pini*°
Cristodendrella		lycii*		meridionalis*°
Cryptochaete	lilacea°			polygonia*°
Gloeopeniophora		laeta*	aurantiaca*° erikssonii* incarnata*° laurentii*° pseudoversicolor°	ovalispora° proxima* scintillans° versicolor* fasticata°
genus DUPORTELLA	kuehneroides° halimi° tristicula*°		malençonii°	miranda°

Tableau 2. Le genre *Hymenochaete* : discordance entre sections (Léger 1990) et groupes définis par l'étude des ITS

Sections	groupe 1	groupe 2	groupe 3	groupe 4	groupe 5
Hymenochaete	borbonica		rubiginosa		pinnatifida
Fultochaete		cinnamomea rhabarbarina	separabilis pseudoadusta rheicolor		
Gymnochaete		hauerslevii		fuliginosa subfuliginosaa	denticulata
Paragymnochaete	carpatica		nanospora		cervinoidea

C. Remarques au niveau des espèces

1. Le genre *Amylostereum* Boid. 1958 (Fig. 6)

Quel chercheur, n'utilisant que quelques croisements, n'aurait pas conclu qu'*A. ferreum* était à synonymiser soit avec *A. laevigatum*, soit avec *A. chailletii*, soit avec les deux ! Mais alors, cela signifiait que *chailletii* et *laevigatum*, totalement interincompatibles, bien reconnaissables et attaquant des conifères différents étaient aussi à synonymiser. Beaucoup d'études fragmentaires de croisements entre espèces géographiquement isolées ont sûrement conduit à des synonymies erronées entre espèces éloignées géographiquement mais encore très proches génétiquement. Il est donc très intéressant de comparer leurs ITS. Sur 538 nucléotides, il y a 15 différences entre *A. areolatum* et *A. ferreum* interincompatibles, 15 aussi entre *A. areolatum* et *A. laevigatum* interincompatibles, et 9 entre *A. laevigatum* et *A. ferreum* partiellement compatibles. Nous ne disposons pas de l'analyse des ITS de *A. chailletii*, qui nous aurait permis de confirmer le nombre de différences entre espèces partiellement compatibles (*A. chailletii* et *ferreum*), et aussi de connaître le nombre de séquences différentes entre espèces européennes incompatibles (*A. chailletii* et *areolatum*), espèces morphologiquement les plus proches.

On peut imaginer qu'*A. ferreum* est restée l'espèce la plus proche de l'ancêtre commun des *Amylostereum* actuels. Les *Podocarpaceae* sur lesquels il vit en Amérique centrale et du sud, existaient en Europe à la fin du tertiaire; leur disparition et les changements climatiques pouvaient provoquer soit la disparition du genre en Europe, soit, au contraire, son adaptation à des gymnospermes de remplacement variées et sa diversification: *Juniperus* et *Taxus* pour *A. laevigatum*, *Picea* pour *A. areolatum* et *Abies* principalement pour *A. chailletii* au cours du quaternaire. Mais cette diversification en cours pouvait être remise en cause si ces espèces naissantes ne mettaient pas en place, dans leurs aires de cohabitation, des barrières d'interstérilité. L'ancêtre, seul en Amérique, n'était pas soumis à cette exigence.

Boidin & Lanquetin (1984a) ont réalisé plus de 400 croisements entre les trois espèces européennes sans jamais observer de boucles. Ce sont trois espèces bien protégées par leur interstérilité. La récolte d'un *Amylostereum* sur *Podocarpus* en Guadeloupe en 1976 avait permis des confrontations avec les trois espèces d'Europe. Si elles étaient toutes négatives avec *A. areolatum*, les confrontations *ferreum* x *chailletii* donnaient 44 % de résultats partiellement positifs, celles entre *ferreum* et *laevigatum* 59 %. Il s'agissait de l'apparition de quelques boucles à la ligne de contact, ou de la formation d'un mycélium dicaryotique sur le territoire de l'un, seulement, des partenaires.

Hallenberg *et al.* (1996) ont signalé un phénomène identique pour un *Peniophora incarnata* de la Terre de Feu qui croise imparfaitement avec une récolte danoise: "*clamp connections were scarce in the matings, and restricted to the confrontation line or unidirectional*". Il est dit aussi dans leur étude "*ITS distinctly separated*". Il faudrait nommer cette espèce.

Ce phénomène d'intercompatibilité partielle, en conditions forcées au laboratoire, entre espèces proches, géographiquement isolées est certainement très courant.

2. Autres cas d'intercompatibilités partielle: le genre *Vuilleminia* et les *Scytinostroma* du groupe *galactinum*

On peut se demander si dans d'autres groupes où ont été détectées des intercompatibilités partielles et des incompatibilités totales, on retrouvera, d'une part un nombre de séquences divergentes significatif de cette situation, et d'autre part si ce nombre est ou non du même ordre.. Pour une bonne comparaison des résultats, nous utiliseront des bandes d'ITS de longueur identique, c'est-à-dire les 175 bases de l'ITS1 qui précèdent le 5,8S, et les 209 bases de l'ITS2 faisant suite à ce 5,8S. Parmi les *Vuilleminia*, seuls *V. alni* et *V. coryli* ont, lors de confrontations d'haplontes, montré localement, et tardivement, quelques boucles (Boidin *et al.* 1994). Leurs ITS diffèrent par 17 séquences (12 en ITS1 et 5 en ITS2), ce qui est nettement plus qu'entre les *Amylostereum ferreum* et *laevigatum* (9 différences). Leur nombre est soit identique (entre *V. alni* et *comedens*) soit supérieur entre *Vuilleminia* incompatibles (Tableau 3).

Tableau 3. Nombre de nucléotides différents sur les ITS1 et 2 de quatre *Vuilleminia*

VUILLEMINIA	coryli	comedens	cystidiata
alni	17	17	55
coryli		31	65
comedens			42

Ce nombre, compté seulement pour l'ITS2, est encore nettement plus important pour les *Scytinostroma* du groupe *galactinum*. On notera (Tableau 4) que les différences sont plus nombreuses, ici, entre espèces jumelles partiellement intercompatibles (Boidin et Lanquetin 1987).

Tableau 4. Nombre de nucléotides différents sur les ITS2 de *Scytinostroma* utrasp. *galacticum*

SCYTINOSTROMA	africano-galactinum	neogalactinum
eurasiatico-galactinum	38	42
africano-galactinum		48

3. Cas d'espèces morphologiquement proches mais totalement incompatibles

Les *Peniophora quercina* et *simulans* morphologiquement semblables, diffèrent par 4 mutations sur l'ITS1 et 3 mutations sur l'ITS2, soit 7. Que faut-il en conclure? Hallenberg *et al.* (1996) qui ont comparé *P. aurantiaca* et *P. erikssonii* ont trouvé 2+5, soit aussi 7 différences. Il s'agit ici de deux espèces très étroitement apparentées certes, mais aisément reconnaissables à l'absence de boucles du second, qui est une forme parthénogénétique fixée issue du *P. aurantiaca*, mais indépendant et qui mérite le rang spècifique.

4. Cas des espèces à synonymiser

On peut retenir le cas des *Hymenochaete fuliginosa* et *subfuliginosa* que certains auteurs synonymisent; ils n'ont que 4 différences en ITS1 et aucune en ITS2, ce qui peut militer en ce sens. Plus proches encore sont les *Peniophora quercina* et *suecica*. Ce dernier, qui n'était connu que par le type, a été retrouvé sur *Quercus* en France (Lanquetin *et al.* 1987). Il ne diffère qu'en 2 sites, un dans chaque ITS, ce qui est fort peu (probablement le bruit de fond du séquençage), et inciterait à le considérer comme une forme de *P. quercina*.

5. Nombres de différences entre espèces indiscutées

Entre *Stereum rugosum* et *sanguinolentum*, on note 8+18, soit 26 différences. Celles-ci sont plus nombreuses entre les *Dichostereum* testés (Tableau 5).

Tableau 5. Nombre de nucléotides différents sur les ITS1 et 2 de *Dichostereum*

DICHOSTEREUM	pallescens	rhodosporum	effuscatum
durum	60	92	112
pallescens		103	111
rhodosporum			120

Entre *Cymatoderma dendriticum* et *elegans*, on note 63 différences dans l'ITS2 (209 bases). Elles sont moins nombreuses entre *Duportella* (Tableau 6).

Tableau 6. Nombre de nucléotides différents sur les ITS2 de *Duportella*

DUPORTELLA	halimi	malençonii	kuehneroides	tristicula
miranda	16	16	22	21
halimi		21	22	23
malençonii			29	33
kuehneroides				16

Il ressort de ces quelques comparaisons, bien que fort intéressantes, qu'elles ne permettent pas de fixer le nombre de mutations acceptables à l'intérieur d'une espèce ou celui au-dessus duquel il faut distinguer deux espèces.

D. Identifications des anamorphes: l'exemple des *Rhizoctonia*

Le système de classification des rhizoctones est basée sur la nature multinucléée (*Thanatephorus*) et binucléée (*Ceratobasidium*) de leur hyphes (Boidin, 1958), les groupes d'anastomose et les groupes intraspecifiques qui intégrent aussi des caractériqtiques pathologiques et morphologiques (Fig. 17).

L'étude comparative des ITS a été très utilisée dans le domaine des *Rhizoctonia*; 94 séquences d'ITS, soit une quinzaine de groupes intraspécifiques, ont été déposées dans GenBank (voir la liste des séquences d'ITS des Cératobasidiales). L'analyse phylogénétique de tous ces ITS (Fig. 18) confirme celle de Gonzales (1991) et de Gonzales & Vilgalys (1991) basée sur la comparaison de séquences (env. 900pb) de la grande sous-unité 26S (médaillon de la Fig. 18). La comparaison des figures 17 et 18 montre qu'il y a une concordance presque parfaite entre la classification des groupes d'anastomose et la classification phylogénétique. Les groupes AG1 sont sur une branche à proximité des *Cetatobasidium* et des *Uthatobasidium.* Les AG4 sont sous-divisés en deux sous-groupes, portés sur une branche bien distincte des autres *Rhizoctonia.* La branche portant les AG2, AG8(et AGBI), AG3, AG5 et AG6 correspond aux isolats capables d'anastomose partielle entre eux. Les capacités d'anastomose des AG9 avec les autres AG ne sont pas connues.

Nous avons consideré que chaque grande branche de l'arbre occupe un rang taxonomique spécifique. *Thanatephorus cucumeris* - qui a toujours été considérée comme une espèce composite - est éclaté ici en quatre espèces distinctes : *T. sasakii, T. microsclerotius T. praticola* et *T. cucumeris.* Ces divisions correspondent aux différents taxons étudiés par Gonzales (1991) et par Gonzales & Vilgalys (1991), basées sur la comparaison des séquences de l'ADN 26S.

Thanatephorus microsclerotius (Weber)*comb. nov.*
Basionyme: *Corticium microsclerotium* Weber (Mycologia, 43:727, 1951), *Pellicularia filamentosa* (Pat.)Rogers f. *microsclerotia* (Weber)Exner
Anamorphe: *Rhizoctonia microsclerotia* Mats.
Groupe d'anastomose: 1-IB ; les isolats AG1-IB sont les agents de la maladie du riz appelée "web blight"

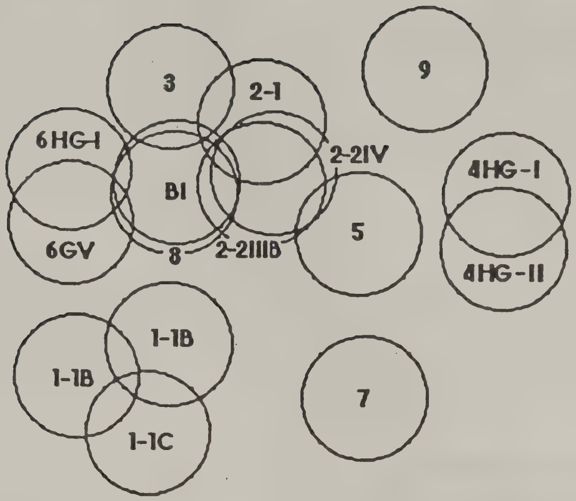


Fig. 17. Relations entre les groupes d'anastomoses de *Thanatephorus* basées sur les affinités des hyphes à s'anastomoser entre elles ; certains groupes (par ex. AG2, AG3, 5, 6 et 8) peuvent s'anastomoser - avec un faible taux de fréquence - avec des isolats de groupes d'anastomose différents (recopié d'après un dessin de Sneh *et al.* 1991)

Thanatephorus sasakii (Shirai)Tu & Kimbr.
Basionyme: *Hypochnus sasakii* Shirai, *Corticium sasakii*, (Shirai)Mats., *Thanatephorus cucumeris* f.sp. *sasakii* Watanabe, *Pellicularia filamentosa* (Pat.)Rogers f. *sasakii*(Shirai)Exner, *Pellicularia sasakii* (Shirai)S. Ito
Anamorphe: *Rhizoctonia sasakii* (Shirai)Exner
Groupe d'anastomose 1-IA ; les isolats AG1-IC sont portés sur la même branchette que les AG1-IA. Les isolats AG1-IA sont les agents de la maladie du riz appelée "sheath blight"

Thanatephorus praticola (Kotila)Flentje
Basionyme: *Corticium praticola* Kotila
Anamorphe: *Rhizoctonia praticola* Kotila
Groupe d'anastomose: 4. L'analyse des séquences confirme l'existence des sous-goupes HG-I et HG-II décrits par Kuninaga & Yokosawa (1984) qui se basaient déjà sur des études d'homologie de l'ADN. Boysen *et al.* (1996), d'après les ITS, décrivent l'existence d'un troisième sous-groupe, mais les isolats de ce nouveau groupe (521, RH2815 et RH2815L) sont affiliés aux *Ceratobasidium*.

Thanatephorus cucumeris (Frank)Donk
Basionyme: *Hypochnus cucumeris* Frank
Synonymes: *Botryobasidium solani* (Prill & Delacr.)Donk, *Corticium solani* (Prill. & Delacr.) Cost. & Duf.
Anamorphe : *Rhizoctonia solani* Kühn
Groupes d'anastomose : AG2-1, AG2-2IIIB, AG2-2IV, AG3, AG5, AG6 HG-I, AG6 GV, AG8, AGBI

Les isolats AG7 capables de s'anastomoser exclusivement avec d'autres isolats AG7 sont portés sur une branchette à part (Fig. 18). Un isolat d'un sarment de vigne (*Vitis vinifera*) occupe aussi une position phylogénétique à part. Les isolats AG10, très peu connus, n'ont pas été étudiés.

E. Identification des formes mycéliennes

Tout récemment Zhang *et al.* (1997), de l'université de l'Iowa, ont déposé dans les banques de données (GenBank, adresse internet: http://www2.ncbi.nlm.nih.gov) 32 séquences d'ITS de champignons basidiomycètes non identifiés, isolés de bambous. Nous disposons d'un certain nombre de cultures isolées de basidiomycètes poussant sur des bambous morts; elles proviennent surtout de France du Sud-Ouest, où les bambous ont été introduits par l'homme, mais aussi de souches de pays tropicaux: République Centrafricaine, Zaïre, île de la Réunion, Guyane. Nos analyses d'ITS n'ont pas, à ce jour, porté sur toutes celles-ci. On comprendra donc aisément que la comparaison des données publiées par Zhang *et al.* avec celles dont nous disposons, ne permettent pas d'identification précise. On peut cependant placer cinq de leur isolats dans les Aphyllophorales : U65614 se situe parmi les *Stereum*; U65608 et U65609 sont avec les *Peniophoraceae* non loin de *Peniophora lilacea*; U65607 se rapproche d'*Oxyporus latemarginatus*; U65623 est proche d'*Hyphodermella corrugata* et d'*Efibula pallidovirens*. L'isolat U65622 se situe parmi les Hétérobasidiés.

L'analyse phylogénétique permetdans certains cas d'identifier les basidiomycètes stériles ou quand les séquences ne sont pas connue de connaître leur affiliation chez les Basidiomycètes. L'exploitation des séquences placées dans les banques de données favorise aussi une communication extrêmement rapide.

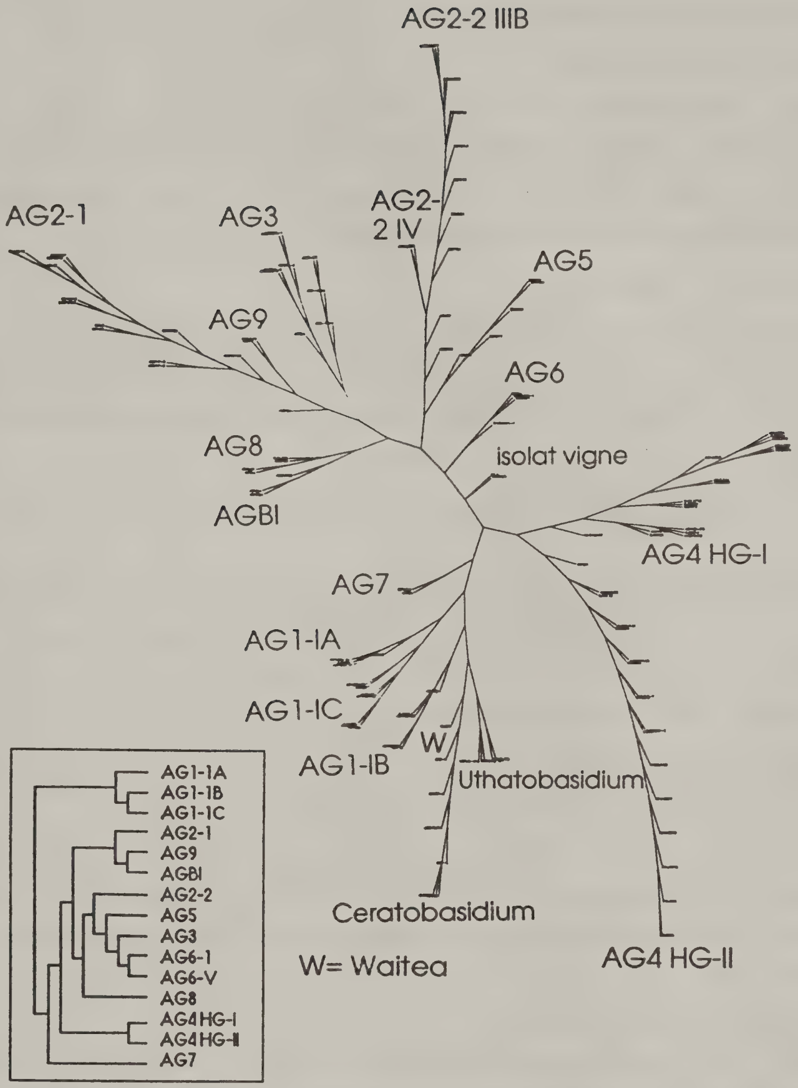

AG2-2 IIIB
AG2-1
AG3
AG2-2 IV
AG5
AG9
AG6
AG8
isolat vigne
AGBI
AG4 HG-I
AG7
AG1-IA
AG1-IC
W
AG1-IB
Uthatobasidium
Ceratobasidium
W= Waitea
AG4 HG-II
AG1-1A
AG1-1B
AG1-1C
AG2-1
AG9
AGBI
AG2-2
AG5
AG3
AG6-1
AG6-V
AG8
AG4 HG-I
AG4 HG-II
AG7

Figure 18. Arbre phylogénétique des Cératobasidiales basé sur la comparaison des séquence des ITS. En encadré, arbre phylogénétique de *Rhizoctonia solani* basé sur la comparaison des séquences de la grande sous-unité 26S (d'après Gonzales, 1991). L'étude de Gonzales avait montré l'existence de plusieurs groupes chez les *Rhizoctonia* ; les trois grands groupes (1) *Thanatephorus cucumeris* de AG2-1 à AG8, (2) *T. praticola* AG4, et (3) *T. sasaki et microsclerotius* AG1, correspondent à ceux établis par la comparaison des ITS. L'AG7 est à part.

F- Ordres et familles nouveaux

Péniophorales ***ordo nov.***
Type : *Peniophoraceae* Maire. 1902. Bull. Soc. Mycol. 18 : 84
Basidioma jacens, margine adhaerenti vel a substrato secessa. Sporae in massa aurantiacae, laeves haud amyloïdeae. Gloeocystidia ope S.A. coloratae vel inertia. Metuloidae saepissima praesentes. Hyphae fibulatae vel efibulatae.

Phlébiales ***ordo nov.***
Type : *Phlebiaceae* Jülich. 1981. Bibl. Mycol. 85 : 385
Basidioma ceraceum, laeve, plicatum, odontoides, merulioides vel porosum. Contextus monomiticus generaliter fibulatus. Nucleus astatocenocytiter se praebens. Parvae sporae laeves haud amyloïdeae. Cum vel sine cystidiolis.

Podoscyphales ***ordo nov.***
Type : *Podoscyphaceae* Reid. 1965. Beih. Nova Hedwigia 18 : 50, *emend.*
Basidioma stipitatum, flabelliforme vel infundibuliforme, dimiticum vel trimiticum, fibulatum. Sporae laeves haud amyloïdeae. Hymenium laeve vel plicatum, interdum verrucosum. Superum latus sterile, glabrum vel tomentosum, vel interdum ramosis caespitibus praeditum. Cum vel sine metuloïdis.

Trametales ***ordo nov.***
Type : *Trametaceae* Boid. *et al.*, ci-après.
Basidioma jacens, jacens-reflexum, dimidiatum vel pileatum. Hymenium laeve vel sterilibus emergentiis ornatum, vel porosum, daedaloide vel lamellatum. Contextus monomiticus vel, saepe, di- vel tri-miticus, saepissime cum fibulis. Sporae laeves haud amyloïdeae.

Vuilleminiales ***ordo nov.***
Type : *Vuilleminiaceae* R. Maire. 1902. Bull. Soc. Mycol. France 18 : 80
Basidioma jacens, margine adhaerenti vel libra, monomiticum saepe fibulatum. Dendrophysae praesentes. Sporae laeves, haud amyloïdeae, in massa albae vel roseolae.

Acanthophysiaceae fam. nov.
Type : *Acanthophysium* (Pilat)G.H. Cunningham. 1963. New Zeal. Dep. Sc. Ind. Res., Bull 145 : 150, 1963

Basidioma jacens vel jacens reflexum, laeve. Sporae laeves amyloïdeae. Acanthophyses et sulfocystidia praesentia. Hyphae fibulatae vel efibulatae.

***Amylostereaceae* fam. nov.**
Type : *Amylostereum* Boid. 1958. Rev. Mycol. 23 : 345
Basidioma jacens adhaerens vel jacens-reflexum, stereiforme et tum dimiticum cum cystidiis incrustatis, brunneis et sulfocystidiis parvis . Fibulae pra

***Gloiothelaceae* fam. nov.**
Type : *Gloiothele* Bres. 1920. Ann. Mycol. 18 : 44
Basidioma ceraceum, monomiticum. Sulfocystidia praesentia. Hyphae cum vel sine fibulis. Sporae laeves amyloïdeae.

***Lophariaceae* fam. nov.**
Type : *Lopharia* Kalchbr. & MacOwan 1881. Fungi MacOwaniani in Grev. 10 : 58
Basidioma jacens vel jacens-reflexum, stereiforme, dimiticum, cum vel sine fibulis. Hyphae skeleticae brunneae ad cystidia incrustata transientes. Sporae laeves, haud amyloïdeae.

***Trametaceae* fam. nov.**
Type : Trametes Fr. 1835. Fl. Scan. 339
Basidioma pileatum vel dimidiatum, solidum, trimiticum, fibulatum. Hymenium porosum, daedaloïde vel lamelloïde. Sporae laeves, haud amyloïdeae.

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DACTYLELLA INTERMEDIA SP. NOV., A NEW SPECIES FROM XISHUANBANNA, YUNNAN, CHINA

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Dactylella and *Monacrosporium* are the two of major nematode-capturing hyphomycetes. What distinguishes these two genera is that the conidia of *Monacrosporium* have a markedly larger cell (longer and wider) (Liu & Zhang, 1994; Subramanian, 1963). During examination of nematophagous fungi and allied hyphomycetes, an interesting fungus with fusiform conidia was isolated. Some conidia of the fungus have slightly larger cells while other do not. The fungus is intermediate member between *Dactylella* and *Monacrosporium*, it is described under a specific name having reference to this conidial feature.

Dactylella intermedia sp. nov. Figs. 1-6

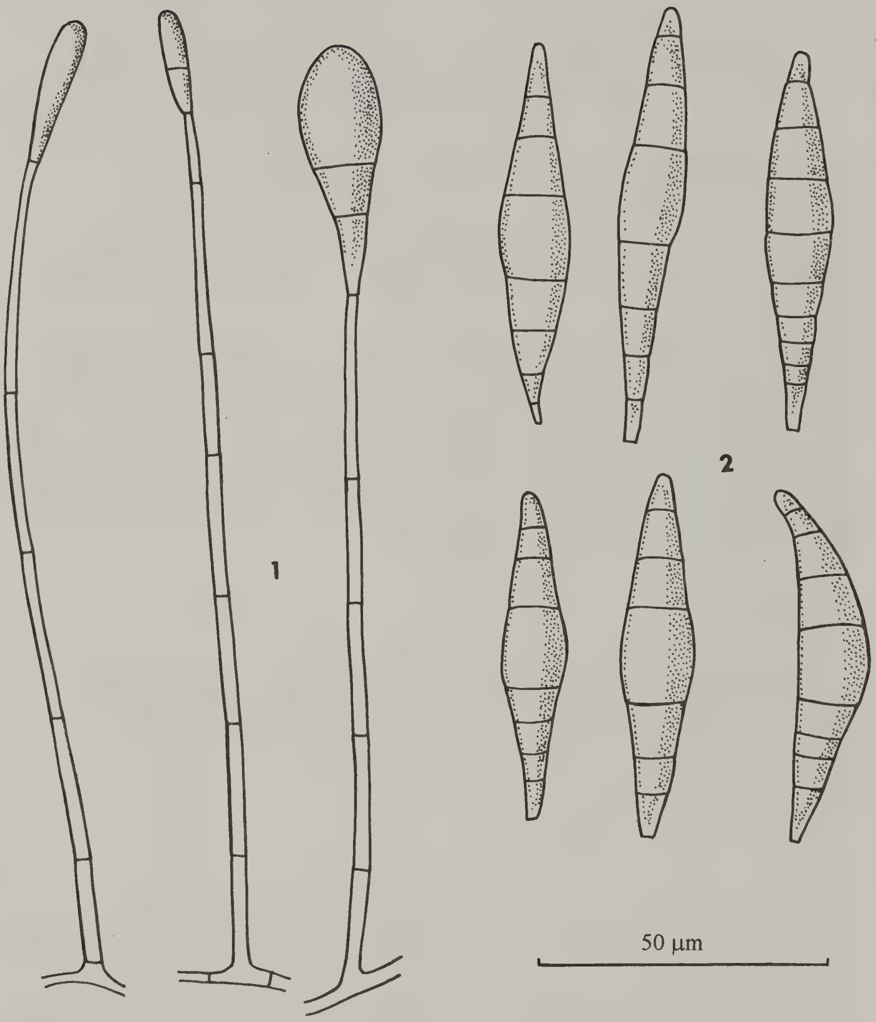
Coloniis in extrato granorum zeae maydis cum agaro albidis. Mycelium sparsum, hyphis sterilibus incoloratis, septatis. Conidiophora erecta, septata, hyalina, simplica, parce ramosa, 48-407 µm longa, 2-3 µm crassa. Conidia hyalina, fusiformia, 5-8 septa, prerumque 7-septata, 42.5-85.5 (65.5) µm longa, 8.0-14.0 (12.0) µm crassa.

Hab.: ex solo pluvialis sylvae, Xishuanbanna, Yunnan Sina, Da-Rong Yang. 11-XII-1993, Holotypus: HMAS 71588.

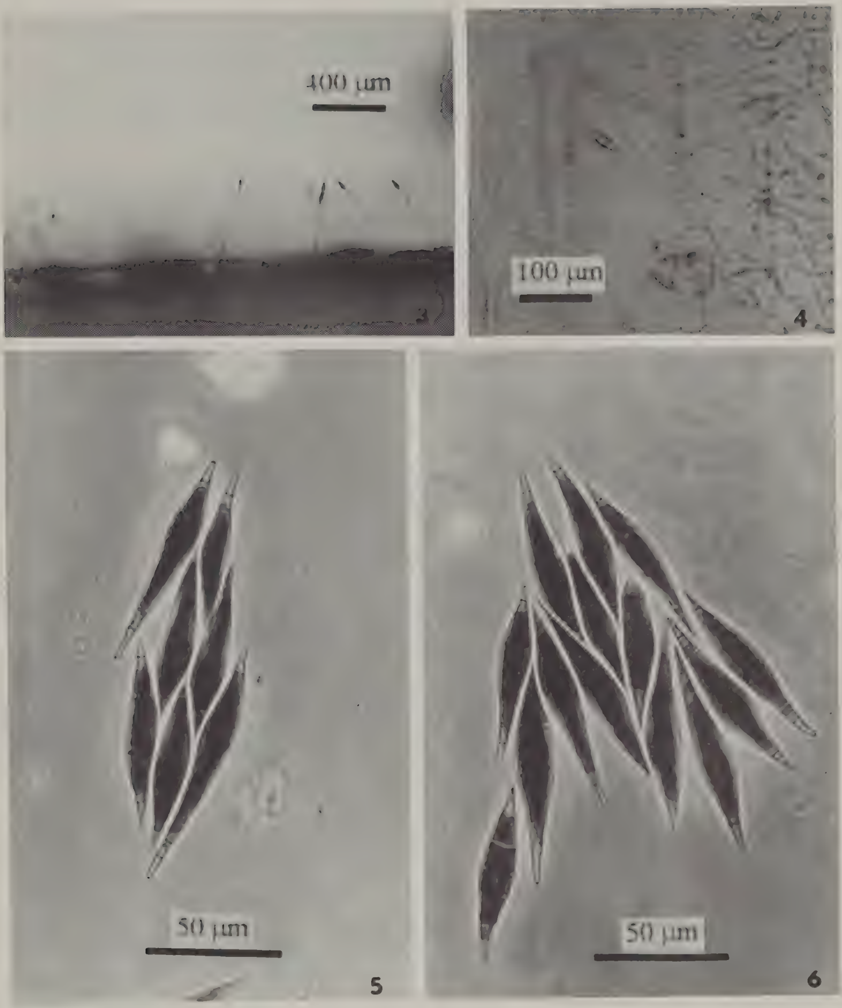
Colonies on CMA whitish, moderate-growing extending a diameter of 4.2 cm within 7 days at 25 °C, producing spare aerial mycelium. Hyphae hyaline, septate, branched, mostly 2 µm wide. Conidiophores erect, hyaline, simple or occasionally branched, 48-407 µm high, 2-3 µm wide, a single conidium produced at the apex of conidiophore. Conidia fusiform, tapering to both ends, 5-8, mainly 7 septa, 42.5-85.5 (65.5) µm long, 8.0-14.0 (12.0) µm wide. Chlamydospores were not observed.

Habitat in rain-forest soil, Xishuanbanna, Yunnan province, China. Da-Rong Yang, 11-XII-1993, Holotype: HMAS 71588.

The fungus resembles *Dactylella rhopalota* Drechsler (1943) in conidial septa and size (3-10, mainly 7 septa, 36-60 × 6.7-9.6 µm), but the conidia of *D. rhopalota* are mostly



Figs. 1-2. *Dactylella intermedia* sp. nov. **Fig. 1.** Conidiophores with conidia. **Fig.2.** Conidia.


400 µm
3
100 µm
4
50 µm
5
50 µm
6

Figs. 3-6. *Dactylella intermedia* sp. nov. **Fig. 3-4.** Conidiophores with conidia. **Fig.5-6.** Conidia.

clavate, occasionally cylindrical, and the conidiophores are branched or successively prolongated at the apex.

ACKNOWLEDGMENT

We wish to thank professor Da-Rong Yang for providing the soil samples, Professor J. Y. Zhuang for correction the Latin diagnosis and professor K. Q. Zhang for reviewing the manuscript.

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来自云南西双版纳一新种——中间指隔孢

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提要： 本文报道了来自云南西双版纳的指隔孢属一新种———中间指隔孢 (*Dactylella intermedia*)。该种的主要特征为分生孢子纺锤形，中间极大细胞不明显，5－8个分隔，以7个分隔为主，42.5-85.5 (65.5) × 8.0-14.0 (12.0) μm。

关键词: 中间指隔孢，新种，云南

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PHOMOPSIS VITIMEGASPORA: A NEW PATHOGENIC *PHOMOPSIS* FROM VINES

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ABSTRACT

Phomopsis vitimegaspora sp. nov., a new pathogen that causes a shoot blight and dead arm of grapevine is described and illustrated.

Grape cultivation on a commercial scale was started in the early 50s' in Taiwan and became popular at the early 60's because of the adaptability of Kyoho grape (*Vitis vinifera* X *V. labrusca* cv. Kyoho) and wine making varities such as Golden Muscat (*Vitis vinifera* X *V. labrusca*) and Black Queen (*Vitis vinifera* X *V. labrusca*) (Yang, 1986). The cultivated areas have been increased steadily since then and reached about 5000ha in 90s'. It was ranked as the second most economically profitable crop in Taiwan. However, grape diseases, especially caused by fungi, are extremely aggressive due to the hot and humid weather of the island. So far 15 fungal diseases have been documented. Among these diseases, some are new to Taiwan (Leu, *et al.*, 1991).
We report here a new species of *Phomopsis* that causes a severe shoot blight and dead arm symptoms of all commercial varieties in Taiwan. The disease has occurred for decades and has been mistakenly identified as '*Phomopsis* dead arm' or '*Eutypa* dieback', two notorious diseases caused by *Phomopsis viticola* (Sacc.) Sacc. and *Eutypa lata* (Per.: Fr.) Tul. & C. Tul. respectively (Carter, 1988; Punithalingam, 1979; Hewitt & Pearson, 1988). The α-spore size of the *Phomopsis* species is 13-18 x 4-5 μm which is much larger than that of *Phomopsis viticola* (Sacc.) Sacc. which α-spore size is only 6-10 X 2.5-3μm (Punithalingam, 1979). In fact, such a spore size is unique among *Phomopsis* species.
To clarify earlier confusion about the cause of dead arm on vines (Moller and Kasimatis, 1981), Koch's postulates were carefully fulfilled to make sure that this fungus did really cause dead arm symptoms. Symptoms of the new *Phomopsis* and of *Phomopsis viticola* are not similar. The new *Phomopsis* causes localized, dark brown or black, ellipsoid necrotic spots on the shoots. Later, lesions coalesce and girdle the shoot, causing shoot blight. When occurring in the woody tissue, dark brown necrotic lesions with distinct margins were seen. The deep brown necrotic lesion can extend deeply into the pith in most cases. *Phomopsis viticola* causes a much milder symptom on canes and seemed rarely to rot the whole cane. The new *Phomopsis* species takes about 8-10 weeks to girdle the young shoot and express die back symptoms. The fungus was not able to colonize mature woody part of vines unless they were wounded. The detail pathology of this fungus on its grape host will be reported elsewhere (Kuo and Leu, 1997). A search for *Eutypa lata*, a plurivorous pathogen on perennial plants, in Taiwan has failed. From the literature a similar *Phomopsis* species in Kyushu, Japan reported by Mikuriya and Sadamatsu (1988) as a causal agent of the swelling arm disease on grape is known; however, comparative material could not be obtained from Japan. *Phomopsis*

longiparaphysata Uecker & Kuo(1992), the other *Phomopsis* species found on grape berries in Taiwan, does not cause similar symptoms. Thus, after a literature review and comparing the Taiwanese *Phomopsis* with the specimens of *Phoma viticola* Sacc., *Phomopsis viticola* (Sacc.) Sacc. and *Fusicoccum viticola* Reddick, a fungus recognized as a synonym of *Phomopsis viticola* (Sacc.) Sacc., the authors identify this fungus as an undescribed species.

Phomopsis vitimegaspora Kuo & Leu sp. nov. (Figs. 1-4)

Conidiomata in ramis emortuis, abundantia, immersa, erumpentia, nigra, conica, usque multistratosis extra obscuris et crassoparietalibus composita. Cellulae conidiogenae hyalinae, simplices, septatae vel ramosae, phialidicae (Sensu Sutton, 1980), usque ad 20 μm longae. α–conidia hyalina, unicellularia, fusiformia vel ellipsoidea, guttulata, (10-)13-18(22) X (3-)4-5(-6) μm. β–conidia abundatia, hyaline, filiformia. In ramis emortuis, *Vitis vinifera* X *Vitis labrusca* L. 'Kyoho'. Hsinshe, Taichung, Taiwan, March 1, 1991, Holotypus IMI 352074, Isotypus TACTRIPV1.

Conidiomata on living twigs, abundant, immersed, becoming erumpent, black, conical, up to 300 μm wide, ostiolate with prominent neck; walls stromatic, composed of several layers of cells, thick-walled and deeply pigmented towards the outside. Conidiogenous cells hyaline, simple, septate, rarely branched, phillalidic, (Sensu Sutton, 1980), up to 20 μm long. α-conidia hyaline, unicellular, fusiform to ellipsoid, guttulate, (10-)13-18(-22) X (3-)4-5(-6) μm. β-conidia abundant, hyaline, filiform, curved, (21-)26-34(-40) x 0.5-1 μm.

Material studied : Canes of grapevines (cv. Kyoho), by KerChung Kuo. Dried cultures—Holotype: IMI352074. Isotype: TACTRIPV1. A living culture has been deposited in the Culture Collection and Research Center(CCRC), HsinChu, Taiwan, ROC.

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The authors thank Dr. Noemi Tornadoree for the loan of specimens of *Phoma viticola* Sacc. and *Phomopsis viticola* Sacc. from the Saccardo herbarium. We also appreciate the assistance and presubmission review of Dr. B. C. Sutton, formly of IMI. Surrey, UK. This research was supported by grants from Council of Agriculture, Taiwan, ROC.

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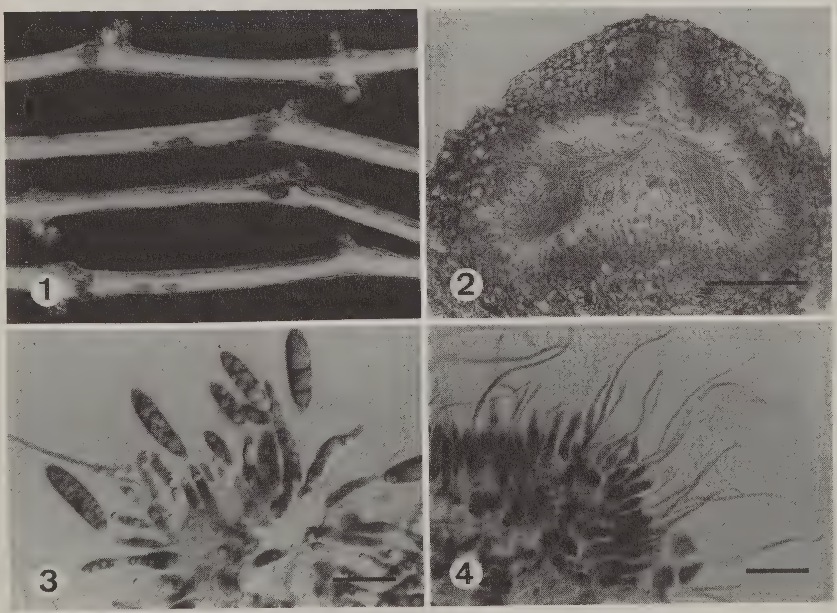
Figs. 1-4. The symptoms of the grape cane blight and the fungus: *Phomopsis vitimegaspora*. 1. The cane necrosis caused by *P. vitimegaspora*. 2. A young conidiomata. Bar=50μm. 3. The α–conidia and conidiogenous cells of *P. vitimegaspora*. Bar=10μm. 4. The β-conidia and conidiogenous cells. Bar=10μm.



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A NEW SPECIES OF *Phyllogloea* FROM MEXICO

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ABSTRACT

Phyllogloea herrerae is proposed as a new species within the genus ***Phyllogloea*** Lowy. This species is characterized by the pale yellow coloration of its basidiomes, elongate spores and cylindrical-arcuate metabasidia. This last character is shared with others species from other genera within the Auriculariaceae and Platygloeaceae, but basidiome form and growth are different. This is the sixth species in the genus worldwide and the second one from Mexico.

Key words: ***Phyllogloea***, ***Phyllogloea herrerae***, Auriculariaceae, Platygloeaceae, Mexico, taxonomy.

Lowy (1959) created the genus ***Phyllogloea*** to classify foliose to lobate species of Auriculariaceae, including a new species, ***Phyllogloea singeri*** Lowy from Bolivia. At the same time he made a new combination, ***Phyllogloea javanica*** (Pat.) Lowy from Java; this species was transferred from the genus ***Platygloea*** Schröt. which had been already considered very heterogeneous by Bandoni (1956) and Olive (1958).

Afterwards only three more species were added: ***Phyllogloea tremelloidea*** Lowy from Brazil (Lowy, 1971), ***Phyllogloea crassa*** Lowy from tropical Mexico (Lowy, 1977) and ***Phyllogloea liui*** Liu & Cao from China (Liu and Cao, 1985). Now a sixth species of the genus and the second one from Mexico is described, which is clearly different from others in the genus.

In the Ainsworth & Bisby's Dictionary of the Fungi (Hawksworth *et al.*, 1995) this genus is classified in the order Platygloeales and the family Platygloeaceae. Oberwinkler (1993), however has observed a species in ***Phyllogloea*** (***P. tremelloidea***) with tremelloid-like features: septa have tremelloid dolipores and basidiospores bud in a tremelloid manner.

DESCRIPTION

Phyllogloea herrerae* Sierra *et* Cifuentes, *sp. nov.

Fructificatio 20-45 mm lata, 19-20 mm alta; lobulata, lobulus parvus, cavus et aggregatus, cartilagineus-gelatinosus; luteolus (Methuen 3A2) vel luteus pallidus (4A3); in sicco ochraceus (5B6) vel aurantiacus-brunneolus (6C8), fragilis; hymenio amphigenus; contextus perangustus, minor quam 1 mm, concolorus, odor et sapore nullo.Subhymenium hyphae 2.25-3 μm lata, filamentosae, cum parietis tenuis et ramigenus sparsus; contextus hyphae 2.8-8.4 μm lata, tumidus vel ampulliformes, sinuosus, cum parietis incrassatis, sine fibulae.

Probasidia aseptata, cylindracea. Metabasidia 36.4-65.8 X 3.5-5.6 μm, cylindracea-arcuatae, cum 3 transverse septata, hyalinus, multiguttulatae. Sterigmata 4.2-11.2 X 2.1-3.6 μm, cylindracea vel subclavata, apice attenuato, semper in convexus latere. Basidiosporae (5.6-)6.3-9.8 X 2.8-4.6(-5.6) μm, subcylindracea vel subphaseolus formae, hyalinae, parietis tenuis et laevis, multiguttulatae.

Holotypus: México. Tlaxcala, Municipio de Tlaxco, Parque Recreativo El Rodeo, cerro de El Peñon, sep. 4, 1992, **Sierra 127 (FCME 4844**).
Paratypus: México. Tlaxcala, Municipio de Tlaxco, Rancho Escondido, Km. 31 carretera Apizaco-Poza Rica, sep. 8, 1989, **Estrada-Torres 2782 (TLXM**).
Habitat: Lignicolous, on unidentified rotten wood, in ***Abies-Pinus*** and ***Abies*** forests, in September. State of Tlaxcala, Tlaxco County.
Etymology: In honor of the eminent Mexican mycologist Dr. Teófilo Herrera who has contributed widely to the knowledge of Mexican mycobiota.

Fructification (**Fig. 1**) 20-45 mm wide and 19-20 mm high, lobulate, lobes small, hollow and crowded, cartilaginous-gelatinous; color when fresh yellowish (Methuen 3A2) to pale yellow (4A3), dry ochraceous (5B6) to orange-brownish (6C8), brittle; hymenium amphigenous; context very narrow, less than 1 mm, concolorous, smell and taste none. Subhymenium hyphae 2.25-3 μm wide, filamentous, with thin walls and scattered branches developing **(Fig. 2a, 3a)**, clampless; context hyphae 2.8-8.4 μm wide, swollen to ampulliform, strongly coiled, with somewhat thickened walls, clampless. (**Fig. 2b, 3b**).
Probasidia aseptate, cylindrical **(Fig. 2c, 3c)**. Metabasidia 36.4-65.8 X 3.5-5.6 μm, cylindrical-arcuate, with three transversal septa (**s**), hyaline, multiguttulate (**Fig. 2d, 3d**). Sterigmata (**st**) 4.2-11.2 X 2.1-3.6 μm, cylindrical to subclavate, apex attenuate, always on the convex side (**Fig. 2d, 3d**). Basidiospores (5.6-) 6.3-9.8 X 2.8-4.9 (-5.6) μm, subcylindrical to subphaseoliform, hyaline, thin and smooth walls, multiguttulate (**Fig. 2e, 3e**); germination not observed.

Observations: This species is easily recognized by the pale coloration of its basidiomes and their very unusual form. All of the known species have carrot colored to brown basidiomes, but those of ***P. singeri*** Lowy fade to light yellowish orange (they are foliose rather than coarsely tuberculate-lobed with hollow lobes). Besides ***P. herrerare*** is distinguished from ***P. tremelloidea*** and ***P. javanica*** by its elongate spores and from ***P. crassa*** and ***P. liui***, which also have elongate spores, by its phaseoliform and smaller basidiospores. Finally, the cylindrical-arcuate metabasidia seem to be an exclusive character of this new species within the genus (see **Tabular Comparison**). This character is also present in several species of other genera such as ***Eocronartium*** Atk., ***Helicobasidium*** Pat., ***Herpobasidium*** Lind., ***Helicogloea*** Pat., ***Platycarpa*** Couch and ***Neotyphula*** Wakefield., which all belong to Auriculariaceae as well (*sensu* Martin, 1952 and Lowy, 1971). The main differences among these genera and ***Phyllogloea*** are basidiome form, growth and habitat.

According to Bandoni (com. pers.) this new species is definitely not Tremellaceous (basidial septa and basidiospore form), but it is necessary to see the septal pores. Exist the possibility that ***Phyllogloea***-like fungi belong to three distinct groups: simple-pored auricularioid fungi, Auriculariaceae with dolipores and Tremellaceae *sensu str*.

It is noteworthy that most species in the genus are only known from the country's type locality and Mexico is the only one with two known species: ***P. crassa*** from tropical rainforest (Veracruz state) and ***P. herrerae*** from temperate coniferous forest (Tlaxcala state) (see **Map**).

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We wish to thank Dr. Robert J. Bandoni for reviewing the manuscript and for helpful comments; Biol. Hector Delgado for reviewing the english version, M. en C. Martha Martínez for reviewing the Latin diagnosis and Biól. Alejandro Kong for the microphotographs. The study was supported by the DGAPA IN-208391, IN-203895 and CONACyT No. PN-0090.

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TABULAR COMPARISON

SPECIES		*P. singeri*	*P. javanica*	*P. tremelloidea*
BASIDIOME FORM		FOLIOSE	FOLIOSE-LOBATE TO CONVOLUTE	THIN FOLIOSE
CONSISTENCY	WET	FIRM-GELATINOUS	GELATINOUS	FIRM GELATINOUS
	DRY	HORNY	?	HORNY
COLOUR	WET	CARROT-RED	BROWN	BROWN
	DRY	FADING TO LIGHT YELLOWISH-ORANGE	?	BLACK
SIZE		20 mm IN GREATEST DIMENSION	12-15 mm HEIGHT	45 mm BROAD 25 mm HEIGHT
HYMENIUM		AMPHIGENOUS	AMPHIGENOUS	AMPHIGENOUS
CLAMP CONNECTIONS		PRESENT	PRESENT	PRESENT
METABASIDIA	FORM	SUBCLAVATE; 3 TRANSVERSE SEPTATE	CYLINDRICAL, APEX OBTUSE, BASE ATTENUATE; 3 TRANSVERSE SEPTATE	BROADLY CLAVATE; 3 TRANSVERSE SEPTATE
	SIZE	(35-)45-68(-76) X 5-6 µm	50 X 6-8 µm	(25-)30-36(-41) X 6.5-9 µm
BASIDIOSPORES	FORM	ELONGATE TO OBLONG	ELLIPSOID TO LENTIFORM	SUBGLOBOSE
	SIZE	9.5-12 X 5-6 µm	10-13 X 6-8 µm	8-9 X 6.5-8 µm
	GERMINATION	BY REPETITION	BY REPETITION OR CONIDIA	BY REPETITION
STERIGMATA	FORM	CYLINDRICAL	?	CYLINDRICAL
	SIZE	45 X 3 µm	"LONG"	40 X 3 µm

? = NO DESCRIBED IN BIBLIOGRAPHY

TABULAR COMPARISON (cont.)

SPECIES		*P. crassa*	*P. liui*	*P. herrerae*
BASIDIOME FORM		LOBATE TO CONVOLUTE	SUBCEREBRIFORM TO LOBATE; BULLATE	LOBULATE
CONSISTENCY	WET	TOUGH TO RUBBERY-GELATINOUS	TOUGH RUBBERY GELATINOUS	GELATINOUS-CARTILAGINOUS
	DRY	HORNY	?	HORNY
COLOUR	WET	CHESTNUT BROWN	BROWN	YELLOWISH TO PALE-YELLOW
	DRY	DARK BROWN	?	YELLOWISH TO PALE-BROWN
SIZE		50 mm BROAD 25 mm HEIGHT	15 mm BROAD 7 mm HEIGHT	20-45 mm BROAD 19-20 mm HEIGHT
HYMENIUM		AMPHIGENOUS	AMPHIGENOUS	AMPHIGENOUS
CLAMP CONNECTIONS		ABSENT	PRESENT	ABSENT
METABASIDIA	FORM	SUBCLAVATE; 3 TRANSVERSE SEPTATE	ELONGATE-FUSOID; 3 TRANSVERSE SEPTATE	CURVED-CYLINDRICAL; 3 TRANSVERSE SEPTATE
	SIZE	(22-)26-34(-38) X 3-4(-5) µm	37.8-41.6(-52.9) X 3.8-5.7 µm	36.4-65.8 X 3.5-5.6 µm
BASIDIOSPORES	FORM	CYCLINDRICAL	ELONGATE TO CYLINDRICAL	ELONGATE TO OBLONG
	SIZE	7-9(-10) X 3-4 µm	(7.6-)8.6-11.3(-13.2) X 3.8-6(-7.6) µm	(5.6-)6.3-9.8 X 2.8-4.9(-5.6) µm
	GERMINATION	?	?	NOT OBSERVATED
STERIGMATA	FORM	NARROWLY CYLINDRICAL	FILAMENTOUS	CYLINDRICAL TO SUBCLAVATE; APEX ATTENUATE
	SIZE	15 X 1.5-2(-2.5) µm	37.8 X 1 µm	4.2-11.2 X 2.1-3.6 µm

? = NO DESCRIBED IN BIBLIOGRAPHY

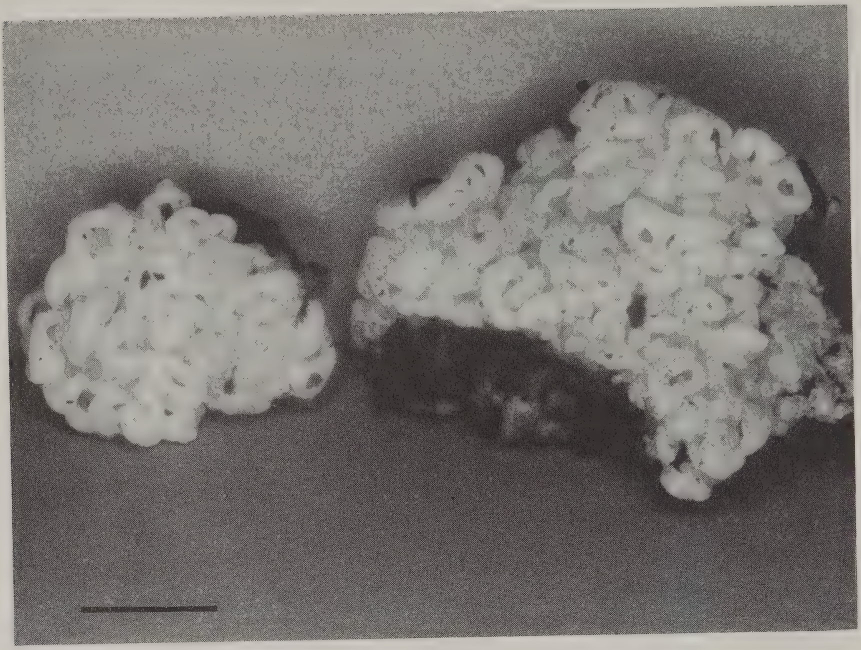
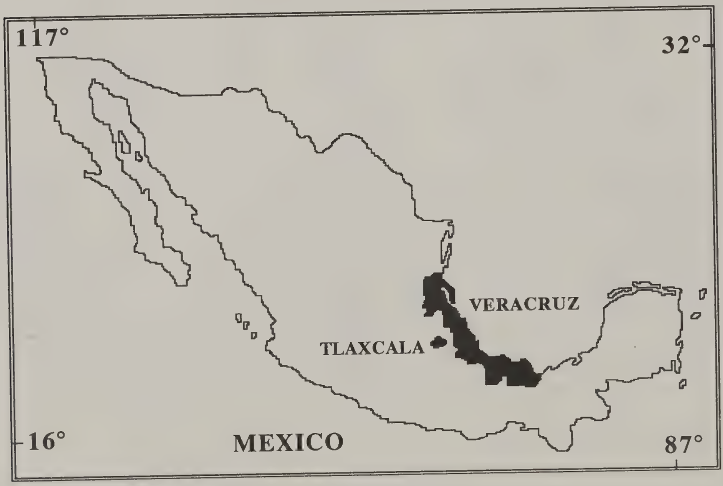


Fig. 1. *Phyllogloea herrerae*, holotype. (Photo: Cifuentes 49-78). Scale bar = 2 cm.


117°
32°
VERACRUZ
TLAXCALA
16°
MEXICO
87°

MAP

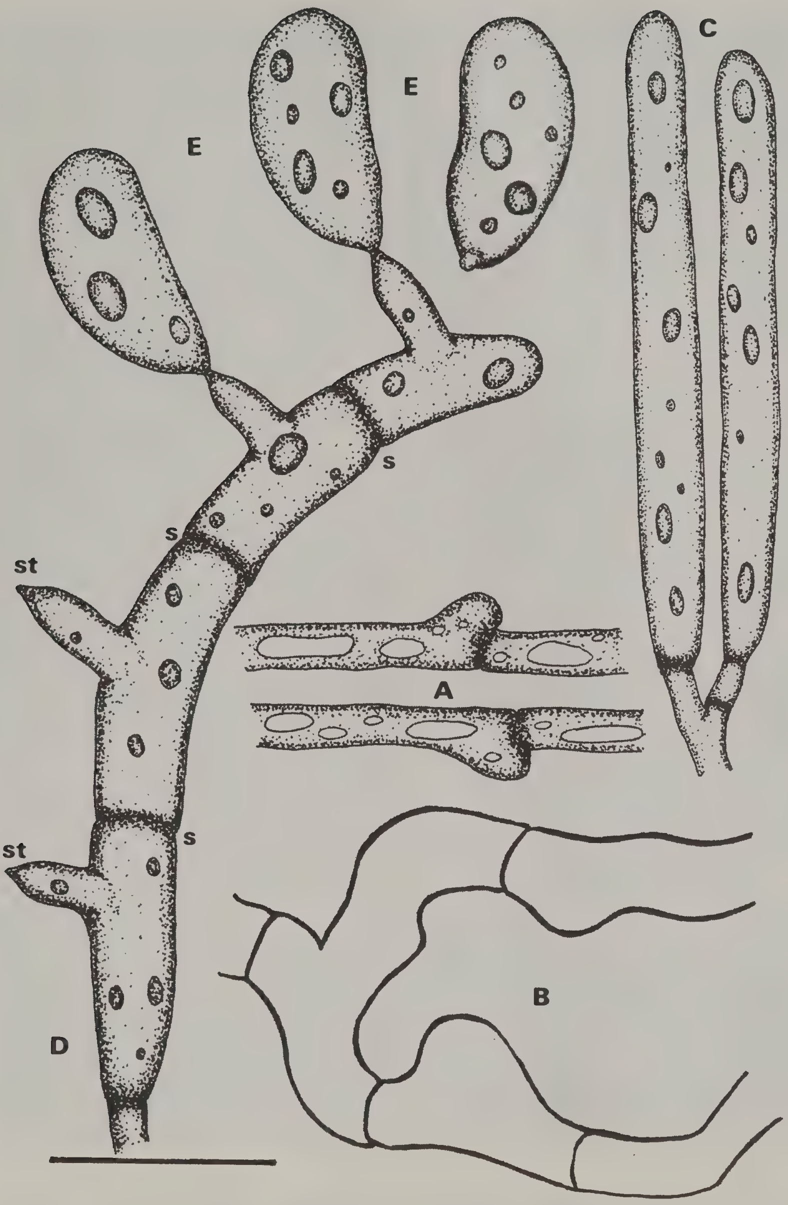


Fig. 2. *Phyllogloea herrerae*. A. Subhymenium hyphae with branches developing. B. Medulae hyphae. C. Probasidia. D. Metabasidia. E. Spores. (s) = septum. (st) = sterigmata. Scale bar = 10 µm.

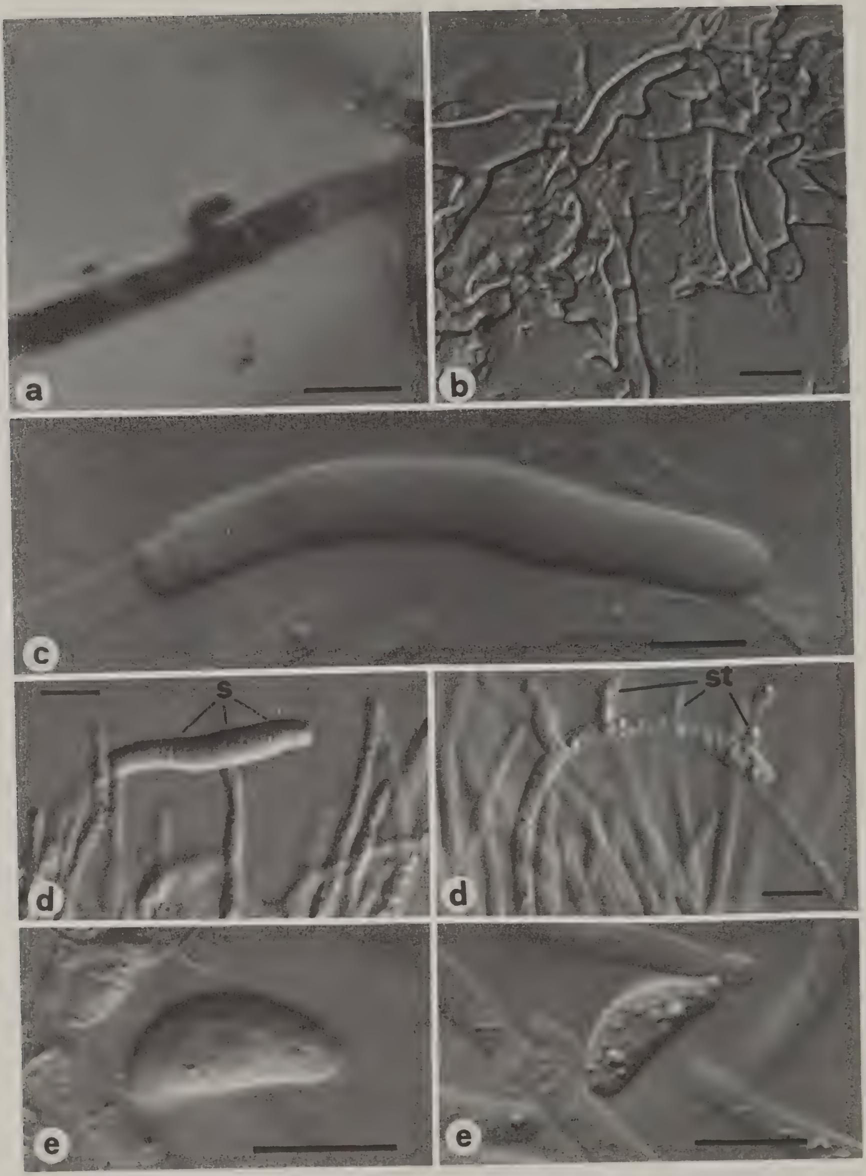


Fig. 3. *Phyllogloea herrerae*. a. Subhymenium hyphae with branches developing. b. Medulae hyphae. c. Probasidia. d. Metabasidia. e. Spores. (s) = septum. (st) = sterigmata. Scale bars in a, c & e = 5 µm; in b & d = 10 µm.

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NEW TELEOMORPHS OF THE ANAMORPHIC GENUS KELLERMANIA

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Abstract: Teleomorphs of two *Kellermania* species are described. The teleomorph for *K. nolinifoliorum* is a species of *Planistromella*. Unexpectedly however, the teleomorph for *K. nolinae* is a species of *Planistroma*, *P. kellermaniae*.

Key words: Ascomycete, *Kellermania, Planistroma, Planistromella.*

INTRODUCTION: During the continuing study of fungi from leaves of some members of the Agavaceae, four species of *Kellermania* Ellis & Everhart have been connected to their teleomorphs, all species of the genus *Planistromella* A. W. Ramaley (Ramaley, 1993, 1995; Barr, 1996). *Planistromella* is the type genus of the Planistromellaceae (Barr 1996), a family having brown-celled, pseudoparenchymatous ascostromata with one or more locules which open schizogenously and contain asci which are often separated and overtopped by interthecial tissues at maturity. *Planistromella* has hyaline, septate ascospores and the only known anamorphs belong to *Kellermania.* *Planistroma* is structurally similar to *Planistromella* but it has hyaline, aseptate ascospores, and the four connected anamorphs, one *ined.*, are species of *Piptarthron* (Ramaley 1991, 1992, 1995). Teleomorphs for two more *Kellermania* species are now established. As anticipated, the teleomorph of *Kellermania nolinifoliorum* A. W. Ramaley belongs in *Planistromella.* The teleomorph of *K. nolinae* (Pollack) Nag Raj is, unexpectedly, a species of *Planistroma*!

MATERIALS AND METHODS: Measurements are from living materials mounted in tap water. Cultures were prepared by rinsing asci three times in sterile tap water and transferring individual asci to commercial potato dextrose agar (PDA) in a petri dish. Axenic growth was transferred to PDA slants. Cultures were maintained on PDA at room temperature on a table top.

TAXONOMY:

Planistromella nolinifoliorum A. W. Ramaley, *sp. nov.* FIG. 1-4.

Stromata atricolorata, linearia, immersa, subepidermalia, plerumque uno latere fissurae stomatis, transectio asymmetrica, 200-750 μm longa, usque ad 250 μm lata, usque ad 250 μm alta. Unus vel plures loculi ascogeni in eodem stromate ac *loculi conidiogeni vel spermatiogeni vel ambo exorientes, asci post conidia vel spermatia formati. Loculi ovoidei ad globosi, 80-135 μm lati, 100-160 μm alti, unistrati, omnes ostiolati. Asci bitunicati, elongati, 90-110 x 22.4-25.6 μm, (4-) vel 8-sporis. Ascosporae aliquantum attenuatae, extremis obtuse rotundatis, base obtusius rotundatis, super septum plerumque submedium latissimae, hemispora infera angustior et plerumque brevior quam hemispora supera, inequilaterales, 33.6-44 x 10.4-13.6 μm, 0-1-septatae, plerumque tarde septatae, hyalinae, leves, tenuitunicatae. Cellulae interthecae abundae ubi asci vetissimi maturi. Anamorphosis Kellermania nolinifoliorum A. W. Ramaley. Habitatio in foliis emortuis Nolina micrantha I. M. Johnst.*

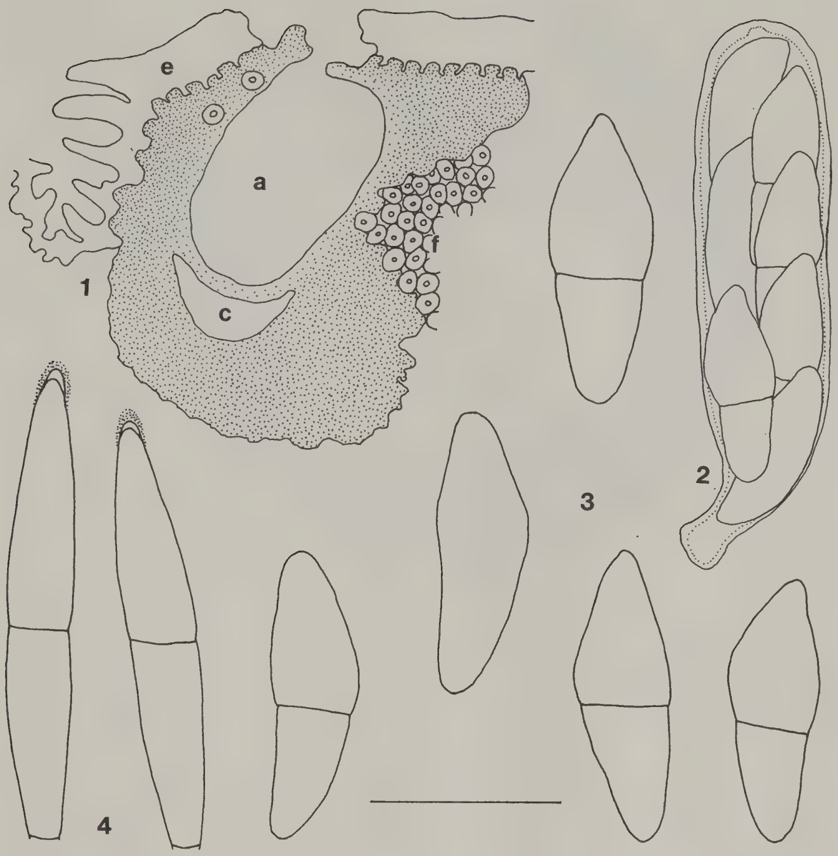
HOLOTYPUS. "U. S. A. TEXAS: Lincoln Co., Valley of Fires, U. S. Hwy. 380, mile 61.15, 21 May 1995," *a Annette Ramaley lectus sub n. 9525A (BPI).*

Stromata dark colored, linear, immersed, subepidermal, usually along only one side of a stomatal cleft, asymmetric in transection (FIG. 1), 200-750 μm long, up to ca. 250 μm wide, and up to ca. 250 μm tall. One or more ascogenous locules developing in the same stroma as conidiogenous or spermatiogenous locules or both, asci formed after the production of conidia or spermatia. Locules ovoid to globose, 80-135 μm wide, 100-160 μm tall, in a single layer, each with a short-periphysate ostiole. Asci (FIG. 2) bitunicate, elongate, 90-110 x 22.4-25.6 μm, (4-) or 8-spored. Ascospores (FIG. 3) somewhat tapered, both ends rounded, more bluntly rounded at base, widest above the usually submedian septum, the bottom hemispore narrower and usually a bit shorter than the top hemispore, inequilateral, 33.6-44 x 10.4-13.6 μm, 0-1-septate, often tardily septate with septate and aseptate spores within the same ascus (FIG. 2), hyaline, smooth, thin-walled. Interascal tissue is plentiful when the oldest asci are mature. The anamorphic state is *Kellermania nolinifoliorum* A. W. Ramaley.

Colonies derived from asci of *Planistromella nolinifoliorum* produced conidia (FIG. 4) typical of *Kellermania nolinifoliorum* (Ramaley 1995). Ascomata develop in stromata which have already produced conidial or spermatial locules, so sections of ascomata sometimes include parts of these empty locules (FIG. 1). As with *Kellermania yuccigena* Ellis & Everhart, conidia and spermatia may be produced within the same locule (Ramaley 1993).

Planistroma kellermaniae A. W. Ramaley *sp. nov.*, FIG. 5-8.

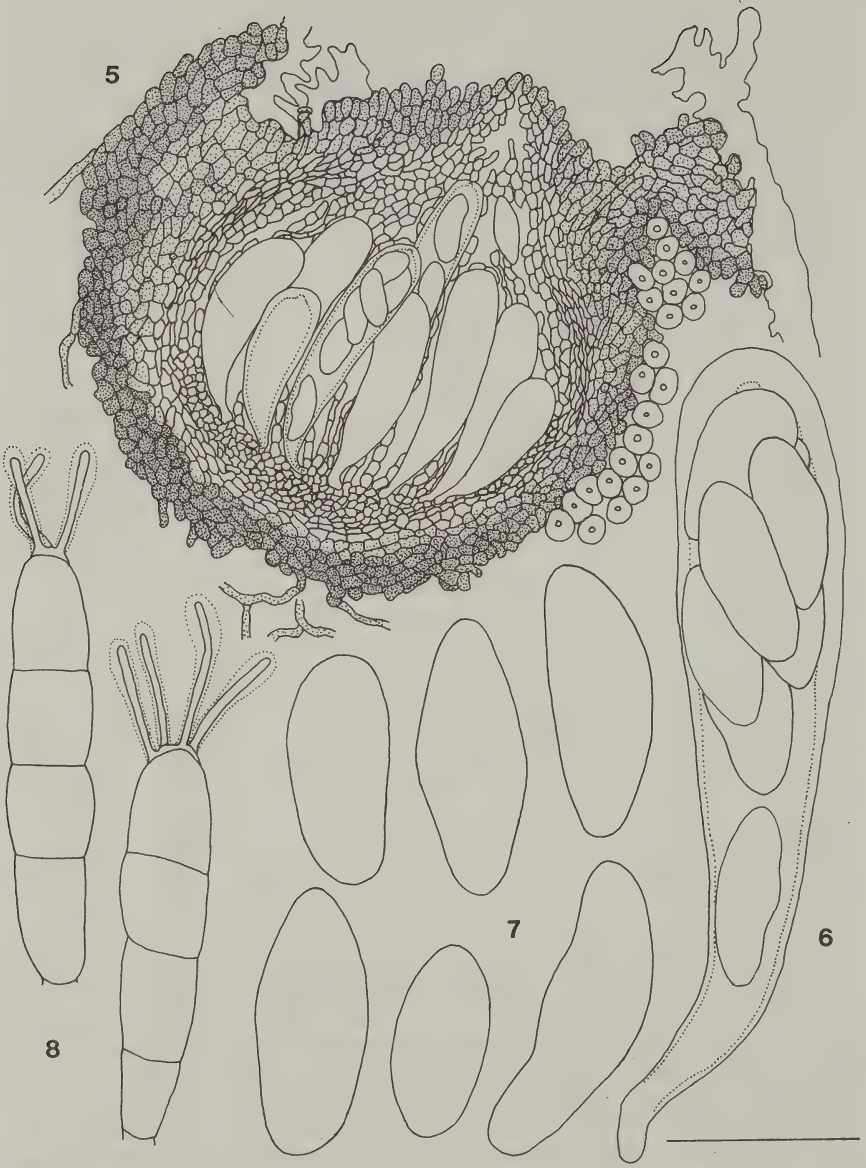
Stromata atricolorata, linearia, immersa, subepidermalia, plerumque uno latere fissurae stomatis, transectio asymmetrica, 375-625 (-875) μm longa, 250-300 μm lata, et plerumque 250-275 μm elata. Unus ad tres loculi ascogeni in eodem stromate ac loculi conidiogeni exorientes, asci post conidia formati. Loculi ovoidei ad globosi in transectio, 170-270 μm lati, 170-290 μm alta, unistrati, omnes ostiolati. Asci bitunicati, elongati-clavati, 120-150 (-190) x (25.6-) 27.2-29.6 μm, 8-sporis. Ascosporae 27.2-42.4 x (10.4-) 12-16 μm, extremis rotundatis, ovoideae vel calceolatae vel rhombeae vel obtuse lunatae, aseptatae, hyalinae, leves, tenuitunicatae. Cellulae interthecae abundae ubi asci vetissimi maturi. Anamorphosis



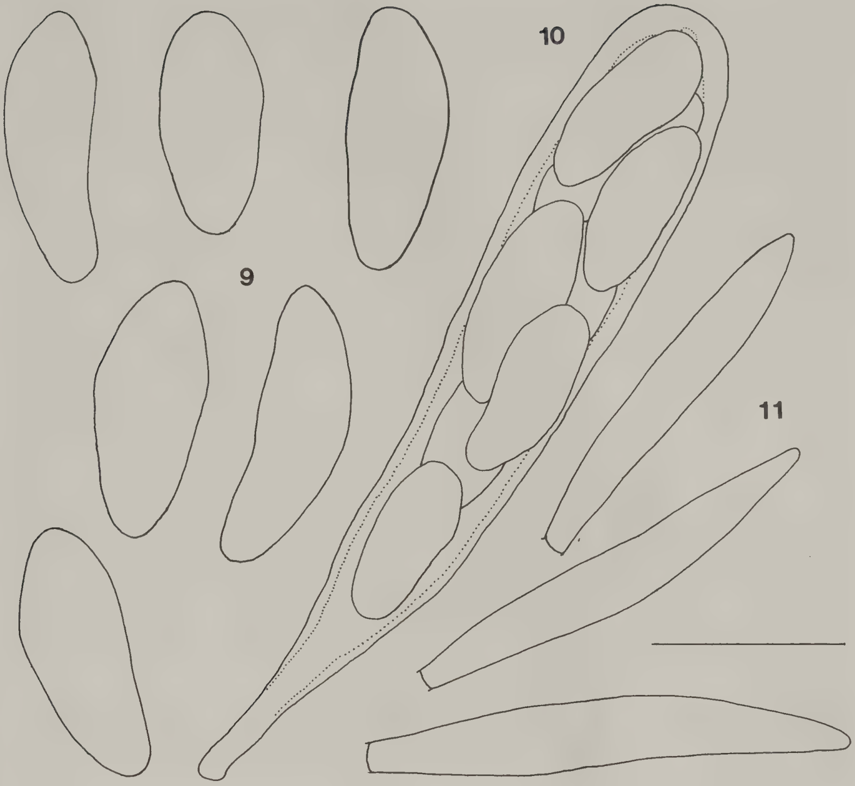
FIGS. 1-4. *Planistromella nolinifoliorum* (A. W. Ramaley 9525A). 1. Median section through ascogenous locule. 2. Ascus with septate and aseptate ascospores. 3. Ascospores. 4. *Kellermania nolinifoliorum* conidia from cultured *P. nolinifoliorum* asci. a=ascogenous locule, c=part of old conidiogenous locule, e=epidermis, f=fibers. Standard line: 1=125 μm; 2=33 μm; 3, 4=25 μm.

Kellermania nolinae (Pollack) Nag Raj. Habitatio in foliis emortuis Nolina erumpens (Torr.) Wats.

HOLOTYPUS. "U. S. A. TEXAS: Brewster Co., Big Bend National Park, along road to Chisos Mtn. Basin 4.7 km from junction with U. S. Hwy. 385, roadside, 23 May 1993," *a Annette Ramaley lectus sub n. 9312D (BPI).*



FIGS. 5-8. *Planistroma kellermaniae* (A. W. Ramaley 9312D). 5. Median section through ascogenous locule in a stroma. 6. Ascus. 7. Ascospores. 8. *Kellermania nolinae* conidia produced in cultures of *P. kellermaniae* asci. Standard line: 5=100 μm; 6=33 μm; 7, 8=25 μm.



FIGS. 9-11. *Planistroma sp.* (A. W. Ramaley 9312D). 9. Ascus. 10. Ascospores. 11. *Piptarthron* conidia from cultures of *Planistroma sp.* asci. Standard line: 9=33 μm; 10, 11=25 μm.

Stromata dark colored, linear, immersed, subepidermal, usually along only one side of a stomatal cleft, asymmetric in transection (FIG. 5), 375-625 (-875) μm long, 250-300 μm wide, and mostly 250-275 μm tall. One to three ascogenous locules developing in the same stroma as conidial locules, asci formed after the conidia. Locules ovoid to globose (FIG. 5) in transection, 170-270 μm wide, 170-290 μm tall, in a single layer, each with an ostiole. Asci (FIG. 6) bitunicate, elongate-clavate, 120-150 (-190) x (25.6-) 27.2 - 29.6 μm, 8-spored. Ascospores (FIG. 7) 27.2-42.4 x (10.4-) 12-16 μm, both ends rounded, ovoid or slipper shaped or rhomboid or obtuse lunate, aseptate, hyaline, smooth, thin walled. Interascal tissue is plentiful when the oldest asci are mature. Anamorphic state *Kellermania nolinae* (Pollack) Nag Raj.

Colonies of *Planistroma kellermaniae* produced *Kellermania nolinae* conidia (FIG. 8) which were both longer and wider than previously reported for the species, 49.6-58.4 x 9.6-12 μm vs. 36-50 x 6.5-10 μm (Nag Raj 1993). Although ascospores are tardily septate in some *Planistromella* species, none of the hundreds of observed mature *Planistroma kellermaniae* ascospores had a septum.

DISCUSSION: Until *Planistroma kellermaniae* was found, all *Planistroma* species had *Piptarthron* anamorphs, and all *Planistromella* species had *Kellermania* anamorphs. Even *K. uniseptata*, a species with conidia resembling those of *K. nolinae*, but one-septate, has a *Planistromella* teleomorph, *P. torsifoliorum* (Ramaley 1995). It will be interesting to discover whether the teleomorph of *K. yuccifolia* (Hall) Nag Raj, a third species with several-appendaged, but aseptate conidia, has a *Planistromella* or *Planistroma* teleomorph. Culturing *Planistroma* to be certain of the connected *Piptarthron* anamorph has already been recommended (Ramaley 1995), and now the connection of *Planistroma* to a species of *Kellermania* emphasizes taking this precaution. *Piptarthron* and *Kellermania* stromata are extremely variable, and those of several species as well as their included ascomata may appear the same and even be located on the same leaf. Some leaves in collection 9312D, in which *Planistroma kellermaniae* was found, bore stromata with locules containing asci and ascospores (FIG. 9, 10) resembling those of *P. kellermaniae* (FIG. 7, 8), but colonies from asci from these leaves grew faster, and were less compact, and easily distinguishable from *P. kellermaniae* colonies. They also produced *Piptarthron* (FIG. 11), not *Kellermania*, conidia. As more information accumulates, it will be mandatory to reassess the validity of the genera involved here--*Piptarthron* vs. *Kellermania*, and *Planistroma* vs. *Planistromella.*

ACKNOWLEDGMENTS: My thanks to the personnel at Big Bend National Park for permission to collect within the park boundaries, and to Margaret Barr for reviewing the manuscript.

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MYCOTAXON

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BOOK REVIEWS

Eric H.C. McKenzie, Book Review Editor

Fungi of Australia. Volume 2A, Catalogue and Bibliography of Australian Macrofungi 1. Basidiomycota p.p. by T.W. May and A.E. Wood (1997). 358 pp., 250 x 175 mm. Australian Biological Resources Study and CSIRO, Canberra. (e-mail: sales@publish.csiro.au). Hardcover ISBN 0 643 05929 6. US$69.95. Softcover ISBN 0 643 05930 X. US$54.95.

The tone of this book is set by the beautiful painting on the cover, and repeated as the front piece, of *Austroboletus occidentalis* by Katrina Syme. The end papers feature a list of the contents of the proposed volumes in the series based on the Walker classification of fungi developed in volume 1A (Walker 1996). The Introduction outlines the philosophy of the series and its scope and arrangement. The series is an ambitious project to produce sixty volumes covering the fungi of Australia. The first volume, of two books, was published in 1996 (see Review, *Mycotaxon* 62: 492, 1997) and this book represents the first of two in the second volume. Volume 2 provides a bibliographic checklist of some 3200 accepted, synonymous, and misapplied names used for macrofungi in Australia. More specifically 2A covers the Agaricales, Boletales, Cantharellales, Gautieriales, Hymenogastrales, Melanogastrales, Phallales, Podaxales, Russulales, and miscellaneous Aphyllophorales. A key to the orders can be found in volume 1A (Walker 1996) but generally they follow the concepts outlined in the 7th edition of the *Dictionary of Fungi*. Any changes to the *Dictionary's* definitions are outlined at the beginning of each ordinal checklist. The orders included in this book can generally be described as the agarics, boletes and tuberous fungi. For this reason the tuberous or gastroid Phallales are included (*Gallacea, Gelopellis, Hysterangium, Protubera*) and the lamellate and cyphelloid Aphyllophorales (*Austrolentinus, Geopetalum, Henningsomyces, Lentinellus, Lentinus, Neolentinus, Panus, Pleurotus, Plicaturopsis, Podoserpula, Porotheleum, Rectipilus, Schizophyllum, Xerotus*).

The ordinal lists are followed by a list of "extra-Australian species associated with *Eucalyptus*". This is a mixed bag of fungi that may or may not be native to Australia and at this point in time have not been found in Australia. This list only examines the literature for eucalypts as hosts, but the large scale export of Australian plants for horticulture use has probably resulted in other fungal species having been inadvertently deported. This will have resulted in species being described, in countries of higher mycological activity, as native to those countries rather than to Australia. An example of this is *Amanita nauseosa* originally described in 1918 from greenhouses at Kew Gardens (Wakefield 1918) and rediscovered there by Reid (1966). Bas (1969) speculated that *A. nauseosa* was originally either from South Africa, South America, or the U.S.A. Further collections were reported from Mexico (Guzman 1975) and India (Watling 1985). However, Young (1982) suggested that it was endemic to eastern Australia and this appears to have been supported by subsequent collecting (Young 1994).

The book concludes with some 58 pages of references, a list of abbreviations, and is fully indexed. As a mycologist living and working with a fragment of the Gondwanaland mycota I have found this book extremely useful, and for the short period of time that it has resided on my bookshelf I made frequent reference to it. For anyone working in the Southern Hemisphere or wishing to compare its mycota with that of the Northern Hemisphere, I cannot recommend this book too fervently.

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G.S. Ridley, N.Z. Forest Research Institute, Private Bag 3020, Rotorua, New Zealand.

The genus Aleurodiscus *(Basidiomycotina)*. *Synopsis Fungorum* 12: 1-164 by M. Núñez and L. Ryvarden (1997), 220 x 155 mm. Fungiflora A/S, PO Box 95, Blindern, N-0314, Oslo, Norway (e-mail: leif.ryvarden@bio.uio.no). ISBN 82 90724 19 5. NOK220.

This treatment of *Aleurodiscus* recognizes the genus in its broadest sense. The authors explain that this approach was used because of the need to have at hand a comprehensive world synopsis in order to identify the many specimens of *Aleurodiscus s.l.* that they encountered in their collecting in tropical ecosystems. Thus, an identification manual resulted. It treats the genus as including the segregates *Acanthophysellum, Acanthophysium, Gloeosoma, Acanthobasidium,* and *Aleurobotrys*. In fact, it states outright that these genera are placed in synonymy.

Part of the reasoning behind this rather radical decision is that "when it comes to making taxonomic arrangements in the corticioid fungi, we are still at the Linnean stage" (p. 9). The authors state the belief that the genus *Aleurodiscus* cannot be dependably dismembered because of the lack of information as to the phylogenetic meaning of the characteristics used for the separations. Too many of the segregates cannot be placed unconditionally in one genus as opposed to another. In the authors words "...very little is to be achieved by splitting *Aleurodiscus*." The reviewer agrees with this view. In fact, the same can be said of many of the genera of Basidiomycotina being recognized today. This volume acknowledges that several segregate genera are recognized, and lists them and the characteristics on which they are based. But it does not recognize them as useful entities in the identification manual.

The volume is composed of 13 chapters including the index, acknowledgments, nomenclator, and references. The introduction and explanation of the taxonomic arrangement include the information just described. The infrageneric subdivisions with type species designated, and the generic subdivisions are then listed. The "evaluation of characters" demonstrates the inconsistency of the characters and their lack of utility in making generic segregates. The ecology of the species is discussed and keys to the species follow. In the main key the format will probably bother those not well acquainted with English because the designation "Section" seems to be a part of the description and is not associated with the letter of the section, which is at the far end of the line in the dichotomy. There are enough typographical errors to be bothersome but the utility of the volume is not compromised.

The raison d'etre of the volume then follows in the description of the species. The descriptions are brief but adequate and accompanied by line drawings of the microscopic characteristics. Specimen numbers are given for those specimens that were used in making the line drawings, but beyond that no specimens are cited. The authors admit that their examination of specimens was limited. They studied a number of type specimens and representative examples. The result is a very nice, handy identification manual to *Aleurodiscus* species based on a limited sampling. Some species concepts can be argued. Several of the drawings and descriptions of species that I have identified differ from the specimens to which I applied that name, e.g., *A. mirabilis*. In the sense of Lemke, I believe, the basidiospores are distinctly citriform and biapiculate, not like those illustrated here.

The discrepancies discussed here are an indication of the need for research on the species of *Aleurodiscus*. Studies of more specimens from a broader geographic area are needed. The application of methods, other than the traditional, are required to resolve the problems at both the generic and species level. Until that time comes this Núñez and Ryvarden volume will serve the purpose of allowing a name to be placed on most "*Aleurodiscus*" specimens.

Harold H. Burdsall, Jr., U.S.D.A. Forest Service, One Gifford Pinchot Drive, Madison, WI 53705-2398, U.S.A.

The Meliolineae. A Supplement by V.B. Hosagoudar, T.K. Abraham and P. Pushpangadan (1997). 201 pp., 235 x 160 mm. Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram, 695 562, Kerala, India. ISBN 81-900397-2-5. US$30.

Hansford's world monograph of the Meliolineae published in *Beihefte Sydowia* (1961, 1963) is generally used as the authoritative text for this group of fungi. However, Hansford did not include all of the Meliolineae, and several species have been described since this monograph. *The Meliolineae. A Supplement* is an attempt to compile all works published (or omitted) since Hansford's *Monograph*, to facilitate easy reference. The description of each taxon has been rewritten to conform with the style used by Hansford. The *Supplement* also provides a summary of current nomenclature of the taxa treated by Hansford, a key to species provided under each host family, and a key to meliolineaeous genera.

This book is basically a reference text which must be used in association with Hansford's *Monograph*. I have used the text in relationship to meliolineaeous palm species and found it easy to use, and accurate. The host families are listed in alphabetical order and therefore it was easy to locate species occurring on this family.

The major part of the text (pages 41-185) is a list and descriptions of species not treated by Hansford. There is no genus description, but each species is described uniformly, and the type location is given. There is no attempt to re-examine species and no discussions or notes, which is obviously a failing of the text. A list of correct specific endings is provided at the back of the text, which is followed by references and an index.

The text is a compilation of meliolineae from the literature which is easy to use, and appears to be comprehensive. It does not, however, address species concepts in the Meliolineae, but continues to accept species based on host. The individual fungi do not appear to have been re-examined in light of new collections or type material.

The book is certainly a good addition to mycological libraries or specialists working on foliicolous fungi. But beware, the paper and print quality is not up to the standard of modern day publications.

K.D. Hyde, Department of Ecology & Biodiversity, The University of Hong Kong, Pokfulam Road, Hong Kong.

MYCOTAXON

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NOTICE: ANNOUNCING A TEST AND TRIAL PHASE FOR THE REGISTRATION OF NEW PLANT NAMES (1998-1999)

by L. Borgen, W. Greuter, D. L. Hawksworth, D. H. Nicolson & B. Zimmer, Officers of the International Association for Plant Taxonomy (IAPT) [1]

Introduction

From the 1st of January 2000, and subject to ratification by the XVI International Botanical Congress (St Louis, 1999) of a rule already included in the *International code of botanical nomenclature* (Art. 32.1-2 of the *Tokyo Code*), new names of plants and fungi will have to be registered in order to be validly published. To demonstrate feasibility of a registration system, the International Association for Plant Taxonomy (IAPT) undertakes a trial of registration, on a non-mandatory basis, for a two-years period starting 1 January 1998. The co-ordinating centre will be the Secretariat of IAPT, currently at the Botanic Garden and Botanical Museum Berlin-Dahlem, Germany. Co-ordination with present indexing centres for major groups of plants is being sought, in view of their possible active involvement at the implementation stage. The International Mycological Institute in Egham, U.K., has already accepted to act as associate registration centre for the whole of fungi, including fossil fungi.

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[1] Contact address: IAPT Secretariat, Botanischer Garten & Botanisches Museum Berlin-Dahlem, Königin-Luise-Str. 6-8, D-14191 Berlin, Germany.

Registration procedure

The co-ordinating registration centre (IAPT Secretariat), and any associated centre operating under its auspices, will register and make available all names of new taxa, all substitute names, new combinations or rank transfers that are brought to their attention in one of the following ways:

- by being published in an accredited journal or serial;
- by being submitted for registration (normally by the author or one of the authors), either directly or through a national registration office;
- or (for the non-mandatory trial phase only) as a result of scanning of other published information by the registration centres' own staff.

Registration by way of publication in accredited journals or serials

For a journal or serial to be accredited, its publishers must commit themselves, by a signed agreement with the IAPT, to

- point out any nomenclatural novelties in each individual issue of their journal or serial, either by including a separate index of novelties or in another suitable, previously agreed way;
- submit each individual issue, as soon as published and by the most rapid way, to a pre-defined registration office or centre.

Accredited journals and serials will be entitled, and even encouraged, to mention that accreditation on their cover, title page or in their impressum

A permanently updated list of accredited journals and serials is being placed on the World Wide Web (see under: http://www.bgbm.fu-berlin.de/iapt/registration/). This list will be published annually in the journal *Taxon*.

Registration by way of submission to registration offices

Authors of botanical nomenclatural novelties that do not appear in an accredited journal or serial (but e.g. in a monograph, pamphlet, or non-accredited periodical publication) are strongly encouraged to submit their names for registration – and will be required to do so once registration becomes mandatory – in the following way:

- all names to be registered are to be listed on an appropriate registration form, using a separate form for each separate publication;

- the form (in triplicate) must be submitted together with two copies of the publication itself, either to a national registration office (see below) or, optionally, directly to the appropriate registration centre. Reprints of articles from books or non-accredited periodicals are acceptable, provided their source is stated accurately and in full;
- one dated copy of each form will be sent back to the submitting author in acknowledgement of effected registration.

Registration forms can be obtained free of charge (a) by sending a request to any registration office or centre, by letter, fax or e-mail, or (b), preferably, by printing and copying the form as available on the World Wide Web (see above).

Registration offices are presently being established in as many different countries as possible. They will serve (a) as mailboxes and forwarding agencies for registration submissions and (b) as national repositories for printed matter published locally in which new names appear.

A permanently updated address list of all functioning national registration offices is being placed on the World Wide Web (see above). This list will be published annually in the journal *Taxon*.

Registration date

The date of registration, as here defined, will be the date of receipt of the registration submission at any national registration office or appropriate registration centre. For accredited journals or serials (and, for the duration of the trial phase, for publications scanned at the registration centres), it will be the date of receipt of the publication at the location of the registration centre (or national office, if so agreed).

For the duration of the trial phase, i.e. as long as registration is non-mandatory, the date of a name will, just as before, be the date of effective publication of the printed matter in which it is validated, irrespective of the date of registration. Nevertheless, the registration date will be recorded, for the following reasons:

- to make clear that the name was published on or before that date, in cases when the date of effective publication is not specified in the printed matter;
- to assess the time difference between the (effective or stated) date of the printed matter and that of registration, since it is envisaged that the date of registration be accepted as the date of names published on or after 1 January 2000.

It is therefore in the interest of every author to submit nomenclatural novelties for registration without any delay, and by the most rapid means available.

Access to registration data

Information on registered names will be made publicly available as soon as feasible, (a) by placing it on the World Wide Web without delay in a searchable database, (b) by publishing non-cumulative lists biannually, and (c), hopefully, by issuing cumulative updates on a CD-ROM-type, fully searchable data medium at similar intervals.

A call to everyone: help testing the system so as to make it work

To make the test effective and significant, it is important that everyone publishing nomenclatural novelties on or after 1 January 1998 should participate by registering all new names and combinations on a voluntary basis. Please help (a) by doing so yourself and (b) by spreading the message to others!

Do not be put off if shortcomings or errors occur in the initial months. Remember, this is a test phase. Let us know of any bug or crinkle in the system, and we will iron it out. What matters is that everything operates smoothly by the end of 1999, and that by the next Congress all have satisfied themselves that it will.

We believe that registration of new names, once implemented in a functional way, will be a great benefit for all concerned with but little inconvenience for cost – and so did the Nomenclature Section at Yokohama in 1993 feel. Nomenclature must be fit for a good start into the next millennium. Let us work together to make it happen.

NOTICE: ANNOUNCEMENT OF A NEW EDITOR-IN-CHIEF

Pavel Lizoň will succeed Jean Boise Cargill as Editor-in-Chief of *Mycotaxon*, beginning with volume 68 (July-September 1988) of the journal. All new manuscript submissions should be directed to Dr. Lizoň at the following address:

Dr. Pavel Lizoň, Editor-in-Chief, MYCOTAXON
Plant Pathology Herbarium, 401 Plant Science Building
Cornell University, Ithaca, NY 14853-4203, USA

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